Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XL. NEW YORK, SATURDAY, JULY 19, 1902. No. 3.

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

114 LIBERTY STREET, NEW YORK.

PUBLISHED WEEKLY.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

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ELECTRICAL WORLD AND ENGINEER.

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United States, Canada or Mexico, - - - - - - - - - - - per year, $3.00
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Entered as second-class mail matter at the New York Post Office.

NEW YORK, SATURDAY, JULY 19, 1902.

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A LOWER PRICE FOR CURRENT.

On another page we publish the text of an important circular just issued by the New York Edison Company, announcing a heavy reduction in the price of current to date from September 1. The new scale applies to the maximum rate, and the reduction is not less than 25 per cent., which is the more remarkable in view of the fact that pretty well everything else one can mention is higher in price and is still going up to heights unknown at any time past, whether in the shortness of war or the prosperous days of peace. Hence, householders and dwellers in residences when they return to New York City next fall, will find something that is materially reduced in cost, and we shall be very much surprised if they do not avail themselves very liberally of the new rate. It would probably not be at all exact to say that it puts electric light to the small retail user at the same price as gas, but when other considerations are taken into account, the conditions become fairly even, and electricity can certainly compete for its share of the business on more advantageous terms than have prevailed on Manhattan Island since the introduction of the electric light twenty years ago.

It will be very interesting to note the effect of the new scale of 15 cents and downward on residence lighting. Doubtless the management of the company has gone carefully into the prospects of increased sale of current, and perhaps in due time we shall be able to learn how far their calculations and expectations have been realized. We cannot forget that some of those in control of the property have occasionally been credited with an indifference to the public and an intention to "work the thing for all there is in it." We can ourselves only felicitate them upon this direct evidence of a resolve promptly to share economies of production with the public, which even at the worst shows a selfishness that is at least enlightened, and which if regarded impartially is a move upon which any wise and progressive administration deserves to be warmly complimented. The whole electrical industry is touched by such an action as this, for the price of current is to-day the dominant factor in the entire range of electric light, heat, power and traction, or more than 75 per cent. of that domain of human activity covered by the word electricity, and besides most nearly affects the multitude.

A TYPE OF SHORT-DISTANCE TRANSMISSION.

In these days there is a disposition among engineers to turn up the nose of scorn at power transmissions less than a few score miles in length, and to such a contemptible low pressure as 2,500 volts. Yet the short transmissions, like the early one at Concord, N. H., described in our columns last week, have really to bear the brunt of commercial work. They are small individually, but numerous and useful, and do their full share of the world's work in spite of their lack of sensational features. The Concord plant in particular deserves something of the respect due to age, for it was one of the very earliest of American polyphase transmission plants. If our memory serves us correctly, the first three-phase induction motor put into service on this side of the water went into the Concord plant in the very early autumn of 1893, before the hydraulic plant was started. A customer had contracted for service, and wanted it before the water plant was ready. He did not want to get a continuous-current motor for merely a few months of use, and so a small three-phase generator was borrowed and put up in the old steam station in the city. The customer got the first three-phase induction

motor sold and delivered in this country, and later, when the new station was ready, the polyphase equipment was transferred to the transmission circuit.

The Concord plant, too, was one of the first alternating plants to break away from the 2,000-volt limit in its primary circuits, and one of the first to adopt the practice, now standard, of using long secondaries fed from banks of large transformers. It is like other plants on rivers subject to freshets, more or less liable to interruptions from high water, and has been bothered by anchor ice—that greatest pest of hydraulic plants—so that in due season it had to come to an auxiliary steam plant, as many another plant has, and in the course of enlargement has come to direct-coupling and modern methods of governing. And speaking of regulation, the Concord plant was one of the first to try automatic regulation of the generator fields from pressure wires led back from the center of distribution. So, altogether, it is an interesting type of short-distance transmission, and is to-day handling an exceptionally large load for a city so small as Concord. And, even now, where the main transmission has been raised to 10,000 volts, it is interesting to note that the distribution voltage of 2,500 remains where it was put ten years ago, and that present advanced practice has merely moved up to the Concord mark.

THE IONIC THEORY OF CONDUCTION.

The ionic theory of conduction through liquids, *i. e.*, electrolytes, now rests upon a reasonably well fortified base. The ionic theory of conduction through gases is in very general provisional acceptance; and now the guns of the ionic theory are brought to bear upon the conduction of electricity through metals, *e. g.*, copper wires. It would seem that the jostling of molecules or atoms in gases beget a few free corpuscles or ions in every second of time; the more accentuated elbowing of the more compressed atoms or molecules of electrolytes keeps myriads of ions always on the shelf of opportunity, and the yet more active collisions of adjacent atoms in solids brings enormous numbers of ions into temporary existence; so that at any instant there are always hordes of them at command. It is suggested that, allowing for the great disparity in the numbers of ready ions ,their proximity and mean free path or sphere of influence, the phenomenon of conduction is essentially the same in insulators, electrolytes or metallic conductors.

A recent research at the Cavendish Laboratory, published by Mr. J. Patterson, in the June number of the *Philosophical Magazine*, throws light on this important theory. A flying ion is bothered by a magnetic field. If the direction of the field be parallel to the initial velocity of the ion, the ion describes a corkskrew spiral about that direction as axis. If, on the contrary, the field is transverse to the initial velocity, the ion moves in a cycloidal path. In either case the ion is delayed, with its encumbent electric charge, and the process of conduction is interfered with. In technical language, the resistance is increased. By measuring the increase in the resistance of conductors, when subjected to measured magnetic fields, much can be learned concerning the supposed active ions in the conductor. It has long been known that bismuth undergoes a distinct and readily measurable increase of resistance in a magnetic field. In fact, field intensities are most conveniently measured by an ohmmeter and a thin bismuth flat spiral. But according to the ionic theory, the effect should be met with not only in bismuth, but also in every metal; although no necessary limit existed as to the magnitude of the effect. Whatever the magnitude of the effect may be, it should, however, increase as the square of the transverse field intensity.

Mr. Patterson examined the resistances of fine spirals of different metals in powerful transverse magnetic fields, using intensities up to 29.2 kilogausses. In all materials except German silver, he found a small increase of resistance, which appeared to vary as the square of the gaussage. In cadmium, the increase was most marked, amounting to nearly one-quarter of one per cent. at the highest gaussage used. In platinum it was the least, being only one two-hundredth of one per cent., or some fifty times smaller. Working out the results on the ionic theory, the acceleration developed in these metallic ions in unit electrostatic field varies between 4 and 27 bicrons per second, the mean free path being from 6 to 41 bicrons. The number of ions per cubic centimeter is about one hundred times the accepted number of molecules in a cubic centimeter of gas at standard temperature and pressure. Silver and copper behaved in all respects very nearly alike, as their close agreement in normal resistivity would suggest.

According to this theory, the conductivity of a metal is equal to the product of the total free ionic charge per cubic centimeter and the square of the acceleration under unit impressed electrostatic field. If this view is correct, then the more numerous the ions, or the more thoroughly disrupted the atoms in the metal, the better conductor it should become. Perhaps it might be possible some day to employ patent ionized copper wire of 2,000 per cent. Matthiessen conductivity at normal temperatures. One can scarcely imagine the economic revolution that would follow in electrical engineering.

ELECTROLYSIS FROM ELECTRIC RAILWAY CURRENTS.

We regret to note that one of our electrical contemporaries has seen fit to reopen in a sensational manner the question of electrolysis from electric railway currents. Though the matter of corrosion by leakage from railway return currents was some years ago one of much concern, with the advance of the electric railway art and as a consequence of the thorough study given the subject by engineers, it is now known, even to the tyro in electric railway engineering, that in the relatively few cases in which injury from the corrosion of underground piping is apt to occur, a definite remedy is indicated by the local conditions. This has become so well recognized that even the daily newspaper press has ceased to harp on a subject which at an earlier time could always be depended upon to supply copy with a thrill in it. Until this condition was reached, corrosion from railway currents was one of the principal means with which to harass electric railway companies in the case of friction with city authorities, and our contemporary is taking upon itself a very grave responsibility when it puts forth the wild statement that "the time is beginning to arrive when reckoning of a gigantic character is to be had between electric street railway companies and those who employ buried piping systems for various purposes." The technical competency of the writer who would thus resuscitate a question that in the past has been so annoying to the electrical railway industry, may be gauged from the remedy proposed for the alleged great danger—the insulation of all joints of underground piping! And it is left an open question as to whether or not railway companies should bear the expense of applying this extraordinary remedy. It is not our custom to refer in criticism in these columns to our electrical contemporaries, but we must make an exception in this case in view of the serious damage that might be inflicted upon a great industry by such an ill-judged editorial utterance; for though none with any technical knowledge would give it a moment's consideration, the newspaper press is apt to accept the statements to which we refer as the opinion of one competent to speak on the subject, because they happened to appear in the columns of an electrical journal.

ELECTROLYTIC CONDENSERS IN ALTERNATING-CURRENT CIRCUITS.

A paper on this subject, by Messrs. A. Trowbridge and E. R. Walcott, was read at the recent Pittsburg meeting of the A. A. A. S. It contains some interesting experiments on electrolytic cells carrying from 10 to 20 amperes under alternating current pressures of about one volt. The frequencies were 60 cycles and 144 cycles. The electrodes were metallic plates, immersed in the electrolyte, and separated by one or more sheets of paper. The apparent capacity of these cells is enormous by comparison with the capacity of electrostatic condensers, but it is only obtained at the expense of energy loss. The efficiency of good electrostatic condensers is very high, approaching 99 per cent. in some cases; while the efficiency of these electrolytic condensers is quite low, roughly about 50 per cent. in some cases. In other words, the power factor of an electrostatic condenser is usually very small, and the phase displacement of its current, ahead of the terminal e. m. f. nearly 90 degrees; whereas the power-factor of these electrolytic condensers was frequently as high as 60 per cent., and the capacity reactance nearly equalled by the internal resistance.

It has been due apparently to this large internal resistance, and consequent waste of energy, that the electrolytic condenser has not come into use on alternating-current circuits for the purposes of phase displacement. The apparent capacity of the apparatus is ample, and there is no difficulty in securing the requisite number of microfarads, but the apparatus gets hot under load and wastes power to a prohibitive degree. For the purposes of artificial lines in experimental telegraphy, where no great precision is desired, and where retardation is sought for without any accuracy as to its adjustment, the electrolytic condenser may become a very useful apparatus. Up to the present time this seems to be its only sphere of application. It is a pity that it cannot be freed from internal waste, because the contrast in bulk and cost between one farad in electrolytic and electrostatic condensers is amazing.

THE PROBLEM OF THE AUTOMOBILE.

The present season brings automobilism into a more conspicuous position than it has before occupied, but we regret to say that in general the electric machine is not taking the prominent place which it ought to have. The cause of this backwardness is not far to seek, although somewhat complex. In the first place, the dismal failure of public electric automobiles in several cities tended to give the motive power a black eye irrespective of its real merits. Secondly, so far as private automobiles are concerned, the lack of proper charging facilities outside of the larger cities and towns is discouraging to those who are fond of touring. Gasoline is available everywhere, and the supply can be promptly replenished, while charging a battery is always a slow job, and unless all the conveniences are at hand a troublesome one to boot. One does not wish to limit his country tour to lines of travel along which he can strike charging facilities every evening, and the oft suggested programme of sending charged batteries ahead to be taken on at the proper time is one which bespeaks very limited knowledge of the difficulties involved in the task. For twenty years the distribution of charged batteries to the consumer has been a favorite resort of the newspaper electricians, but except on a very trivial scale it has amounted to nothing whatever, nor will it in our opinion ever do so. It is not as some credulous souls have thought, a question of the weight of the battery, within at least the limits of reasonable probability. It is not the fact of a battery weighing one hundred or two hundred pounds that makes the difference, but rather the nuisance of having it replaced at the proper time, be it heavy or light. And one in touring the country wants to have a certain liberty of action which a journey fully prearranged does not and cannot give.

Another cause of the relatively small growth of electric automobiling is the altogether reprehensible present tendency toward scorching. The storage battery in spite of the very fast running that it has sometimes accomplished, is not the chosen motive power of the driver of the Red Devil. It is, too, quickly exhausted if forced to the output required for the record-breaking runs over the country roads, which seem to be the present fashion. Even if the Edison's new battery fulfills the rosiest expectations of its inventor, it will still be ill-suited to this malignant purpose. Unless this recent tendency is put down with a strong hand the whole automobile business may be put out of existence. One-half of one per cent. of the population cannot long continue utterly reckless of the lives and happiness of the other ninety-nine and one half per cent., and if this minority banks upon the wholesale use of its money to escape the penalty of its recklessness, we beg to remind it that buckshot and the rope cannot be bribed, and that from the decisions of Lynch, J., there is no appeal. It will take very little more of the sort of thing we have been having to bring either legislation so drastic as practically to suppress motor vehicles, or a summary resort to that final law of self-defence, which is the substratum of all law. Be this as it may, the electric vehicle does not meet the needs of the scorcher, we are happy to say, and hence it has not yet come to its own. When the automobile settles down to a full realization of the field that is really its own, we have little fear that electric power will not take its proper place of prominence.

In all cities of any size it may be safely assumed that facilities for charging batteries can be easily secured, and the more required the more will be established. The electric vehicle has at least one unique advantage, it can be stopped and started without any annoying preliminaries, and is far simpler to operate than any other known type of automobile. Once the batteries are fully charged, the subsequent operations become very simple indeed. The whole success of the machine turns on the good qualities of the battery. We are not disposed to think that extreme lightness in the battery is a prime necessity, although in itself it is a good thing. The endurance which implies reliability and a low rate of depreciation are the qualities most important. We believe that Mr. Edison attaches far more importance to the mechanical and chemical stability of his new battery than to its efficiency of light weight. In these latter particulars it is not widely different from the lightest lead batteries, ignoring the matter of depreciation. The time has come, we think, for the electric vehicle to be taken up seriously as a means of ordinary urban transportation of passengers and freight, and for a determined effort to forget the past failures in present successes. The earlier vehicles not only were in constant trouble with their batteries, but many of them had very bad motor drives. The gearing that can be heard five blocks away is not a sign of high efficiency, nor of battery endurance. On the whole, we are disposed to think that the present run on steam and gasoline vehicles may prove a good thing from the standpoint of the electrician. It throws a very disagreeable burden of sorrows on the other fellow, and it gives time for a careful, steady attack on the electrical problems involved. It is not a bell hanger's job, this electric automobile business. On the contrary, it requires very careful and intelligent engineering to bring out a successful result. The electric carriages so far built have been good just in proportion to the designer's ability, and a moderate demand is better for judicious and effective work than a rush of business that encourages the production of makeshifts. The best of our builders have all the business they can comfortably handle even as it is, and they will not complain if the demand does not bring competitors.

Reduced Price of Current in New York City.

An important announcement has just been made by the New York Edison Company, reducing the maximum price of current for incandescent and arc lighting 25 per cent., or from 20 to 15 cents per kilowatt-hour. We give the circular below in full:

In accordance with the declared policy of reducing the prices of the electric service of this company as rapidly as possible, consistent with efficient service, we beg to announce that on and after Sept. 1st next, the maximum price for electric current for incandescent and arc lighting will be reduced from 20 cents to 15 cents a kilowatt-hour.

This change is now made possible by the addition to our facilities for the production and supply of electric current of our new Waterside station, at Thirty-eighth and Thirty-ninth Streets and the East River. This station, designed for an equipment of about 130,000 hp, is the largest, the most complete, and the most modern in the world.

The daily average use of the entire installation connected with the meter and service wire—excepting fan motors and heating appliances —will continue to determine the rate of the monthly charge. With this reduction the future schedule of prices will be:

Average Hours' Use	Per Kilowatt Hour	Per Standard Arc Lamp Hour (500 Watts)	Per Incandescent Hour 16 Candles (50 Watts)
1st and 2d	15c.	7½c.	¾c.
3d and 4th	10c.	5c.	½c.
5th and 6th	7½c.	3¾c.	⅜c.
Over 6 hours	5c.	2½c.	¼c.

The existing contracts will remain in force, except as affected by this reduction, and our present records of installation will continue to serve as the basis of determining the average use of current until notice is given in writing of any changes or corrections.

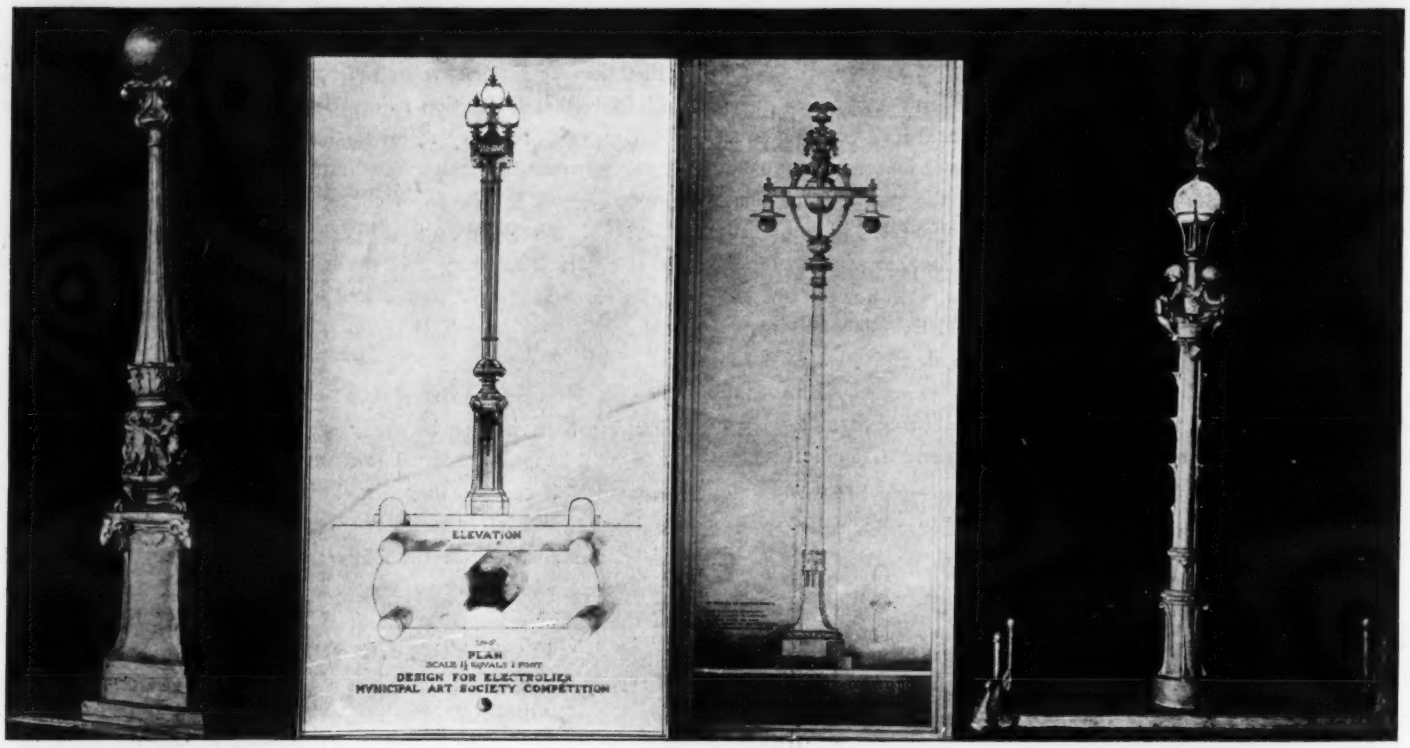
An Electrolier Competition.

The Municipal Art Society of New York City organized recently a competition for the design of an electrolier to be combined with an isle of safety at the intersection of Fifth Avenue and the South side of Twenty-third Street, the electrolier when completed to be presented by the society to the city.

The aim of this excellent organization, whose broad object is to improve artistically public buildings and prominent objects on the city streets, is in this specific case to obtain a simple and beautiful street fixture which may serve as an example for future work; to help divide the traffic; to furnish a place of safety for foot passengers in crossing the wide and crowded avenue, and to afford a place not only for the lamps, but for street signs.

The competition was open to artists without distinction of age or sex, and the jury consisted of 15 members, including ten architects, painters and sculptors and five laymen, among its members being Hon. Jacb A. Cantor, president of the Borough of Manhattan; Mr. F. Crowninshield, president of the Fine Arts Federation, and Mr. John DeWitt Warner, president of the Municipal Art Society. Other members were Messrs. F. S. Lamb, F. B. Herzog, Geo. B. Post and Bruce Price. The first prize was a commission to execute the necessary full-sized drawings and such modeled details as would be required for the execution of the proposed work, for a sum of $500. The second prize was $100, and the third prize, $50.

The regulations required that the design submitted should not call for an expenditure of more than $1,500 for the final and complete execution of the electrolier. A space not larger than 3 feet by 20 feet was given as the size of the isle of safety, upon which the electrolier would be set up. Drawings and models submitted were required to be on the scale of 1½ inch to the foot, and competitors could submit a drawing or a model, or both, the models being in wax or plaster. It was provided that competitive material should be sent in by June 14, and that the jury should render its decision within two weeks of that date.



FIGS. 1, 2, 3 AND 4.—FIRST, SECOND, THIRD AND FOURTH PRIZE ELECTROLIERS.

The competition thus undertaken by the society proved very successful, and no fewer than 45 drawings and models were submitted, all of which have been placed on public exhibition in the rooms of the Architectural League, Fine Arts Building, West Fifty-seventh Street, New York City. Four awards have been made, and we illustrate the designs thus distinguished. The first prize of $500 has been awarded to Victor A. Ciani; the second prize of $100 has gone to Henrik Wallin; the third prize of $50 has been carried off by Wilkinson & Magonigle, while honorable mention has been accorded to the design of Mrs. Edith Woodman Burroughs. The successful competitor is required by the rules of the contest to make the full-sized drawings and modeled details; the Municipal Art Society will take charge of the execution and placing of the work, in collaboration with President Cantor.

We believe that our readers will be very much interested in the designs which we now submit, and will view with favor and approval the effort which has thus been made to improve the electric light poles or lamp posts employed in American cities. Several companies have already made laudable efforts themselves in this direction, notably the New York Edison Company, and they realize that such efforts will enjoy public support and sympathy of an active character.

An Electric Cement-Making Plant.

AN electric power plant recently installed at the Alsen American Portland Cement Works, at Alsen, seven miles below Catskill, Green County, New York, furnishes an excellent example of the adaptability of electric power to meet the severe requirements of cement making machinery. This is the only cement manufacturing plant in America using electrical power so extensively and exclusively. The extended area on which power is required to be distributed, and the heavy overloads under which many of the machines start, constitute the greatest problem in driving machinery in cement mills. These conditions appear to have been successfully met in this installation.

The boiler plant consists of four horizontal water-tube boilers, of 300-hp each, working at 150 lbs. pressure. Natural draft is furnished by a chimney 210 feet in height. The generating plant consists of three cross-compound Corliss-type engines, each direct-connected to 400-kw generators, running at 90 r. p. m. The flywheel and generator are placed between the frames of the high and low-pressure cylinder. There is also one automatic tandem-compound engine direct connected to a 100-kw generator, running at 200 r. p. m. The generators are wound for direct current and 250 volts. A 15-ton crane spans the width of the generator room, and travels the entire length. The room is lighted with arc lamps mounted on ornamental cast-iron posts.

The switchboard is of colored marble, and contains four generator panels, one total load panel, four power panels and one lighting panel. The board is equipped with circuit breakers, illuminated-dial instruments and a recording wattmeter of 5,000-ampere capacity. The service switches are all fused on the back of the board, and the distributing switches are provided with illuminated name plates, which are placed in front of an opening cut through the marble; back of this is connected a lamp, which serves as a pilot lamp for that circuit and illumination for the name plate. Connections are made between the dynamos and switchboard by lead-covered cables carried under the floor of the engine room, excavations around the foundations and under the entire engine room floor providing ample room for the arrangement of cables and connections.

All power generated is electrical, a total of 2,500 hp being developed. Current is supplied to 51 motors and for lighting service. The system of electrical distribution is by means of underground ducts and cables, man-holes being constructed at convenient points throughout the mills, and separate feeders run to each group of motors. The cables generally are of a standard size, 500,000-cm cross section.

FIG. 2.—ELECTRIC DRILLS IN QUARRY.

Motors installed throughout the plant are of the slow-speed type, and are designed and wound for the particular service required of them, individual motors being generally direct-coupled or direct-geared with flexible couplings. Gears are provided with planished

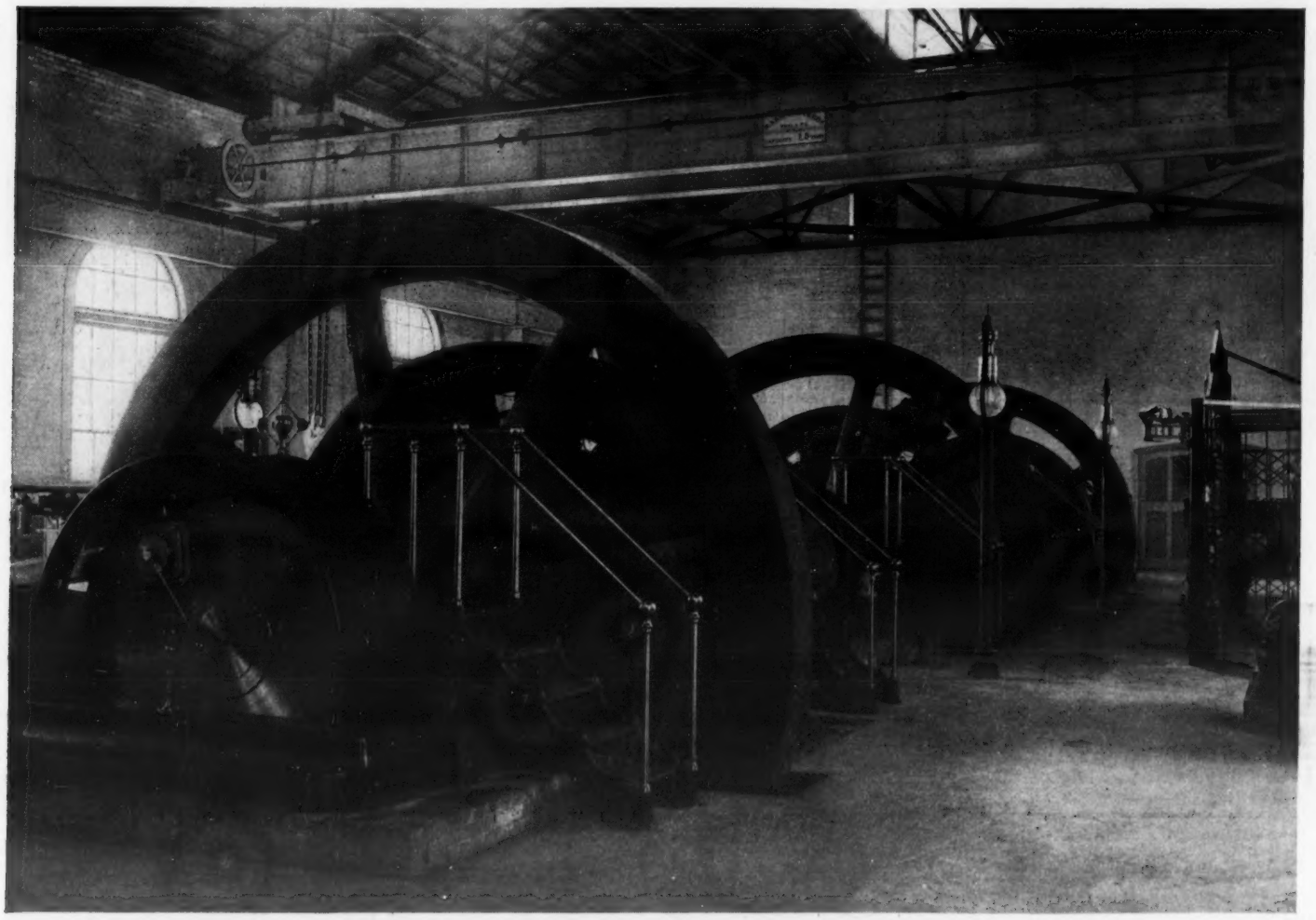


FIG. 1.—ENGINE ROOM, SHOWING SWITCHBOARD AND EQUALIZERS.

iron, dust-proof covers, the arrangement of the covers being such that the gears can be readily inspected; the lower section of the

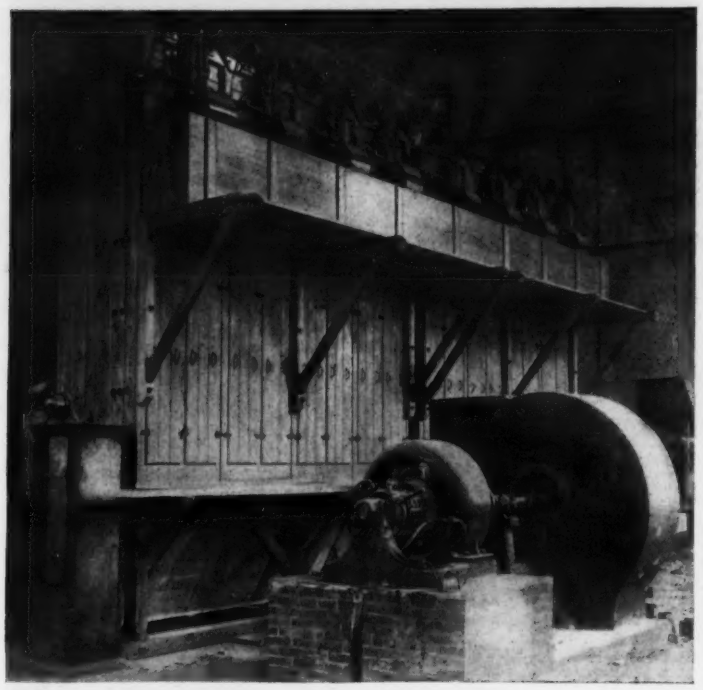


FIG. 3.—DUST COLLECTOR, FINISHED MATERIAL DEPARTMENT.

gear case is a heavy casting set in the foundation construction, which permits of the gears being run in oil.

Each motor is provided with a starting panel mounted on an angle-iron construction, erected on a heavy cast-iron base and enclosed with a planished iron cabinet. Each cabinet is divided into three sections. The first or lower section is designed for the start-

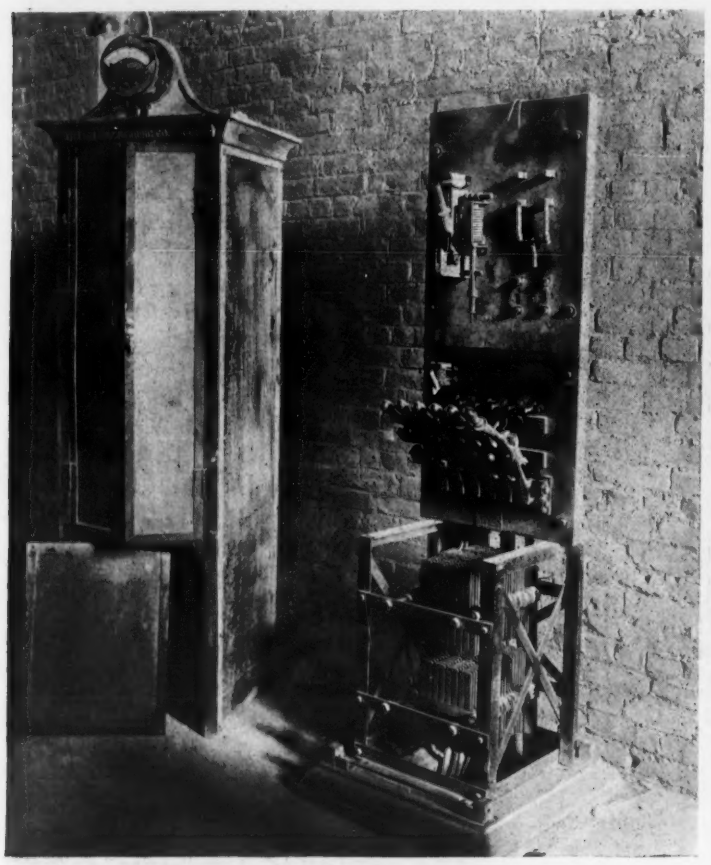


FIG. 4.—MOTOR-STARTING PANEL AND CABINET.

ing resistance, which is unusually heavy, to allow for the severe overloads required to start the various machinery; the second section is designed for the multiple switches for cutting out the resistance, and the third section is designed for the circuit breaker, knife switch and fuse. Circuit breakers are provided with a stop device, arranged to prevent action when the motors are thrown in,

FIG. 5.—DIRECT-CONNECTED MOTOR AND BLOWER FOR FURNISHING AIR TO CLINKER PIT.

thus providing a time element feature. Above the third section, at the top of the cabinet, is mounted, exposed to view, an ammeter and pilot lamp; the ammeter is continuously in circuit, showing at all times the load on the motors.

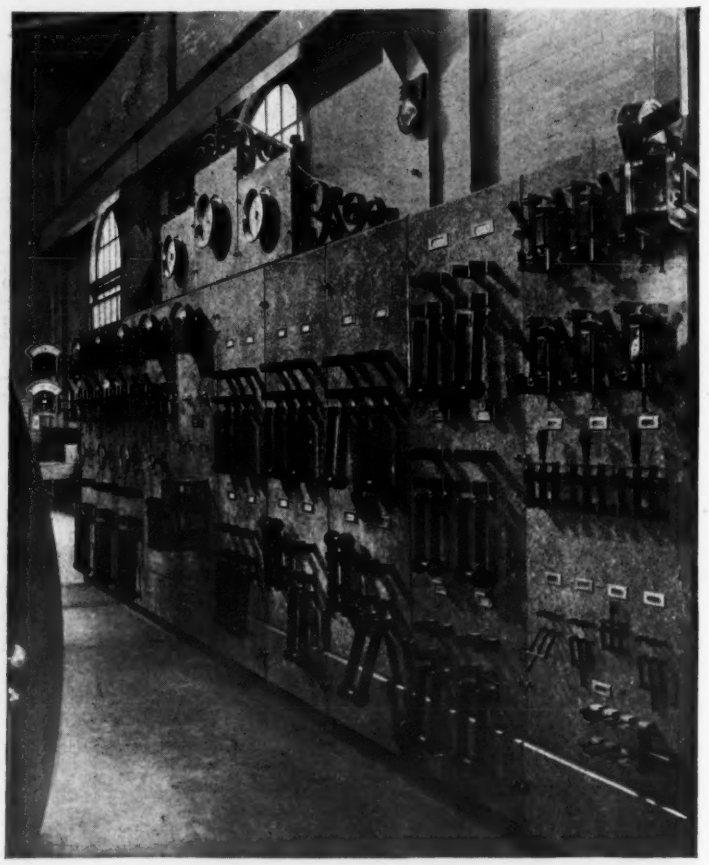


FIG. 6.—ENGINE ROOM SWITCHBOARD.

Cement-dust collectors are electrically operated. Two collectors are installed, one in the raw material department, and one in the finished material department, connection being made from the collector direct to the various machines.

The pumping station is located on the Hudson River, about one mile from the power house, and is connected by a pole line. The motor pump supplies water to a reservoir for boiler feed and condensing purposes and general use.

spindle up and down through the coil. A rotary motion is given to the spindle by means of a rifled rod, ratchet and pawl.

The lighting is installed on the 110-volt, three-wire system, with a duplicate set of motor-generator equalizers installed in the engine

FIG. 7.—EQUALIZING SETS FOR LIGHTING SYSTEM.

The quarry is located about a half mile from the main building, connected by a tram road. Electric drills are used throughout, power being secured from the main generating plant by a pole line connection. At the quarry, a direct-current motor drives an alternating-current generator of low voltage and low frequency, from which the drills are operated. The drills are each provided with double solenoids, which are alternately energized, drawing the drill

room. These equalizers consist of two 5-hp direct-current, shunt-wound motors, connected in pairs on a common bed plate, by flexible couplings. The equalizers are thrown in circuit by means of a triple-break, two-pole switch, resistance being inserted through the different clips of the switch. A double-reading ammeter shows the amount of current furnished to either side of the system.

The buildings are lighted by incandescent electric clusters, which

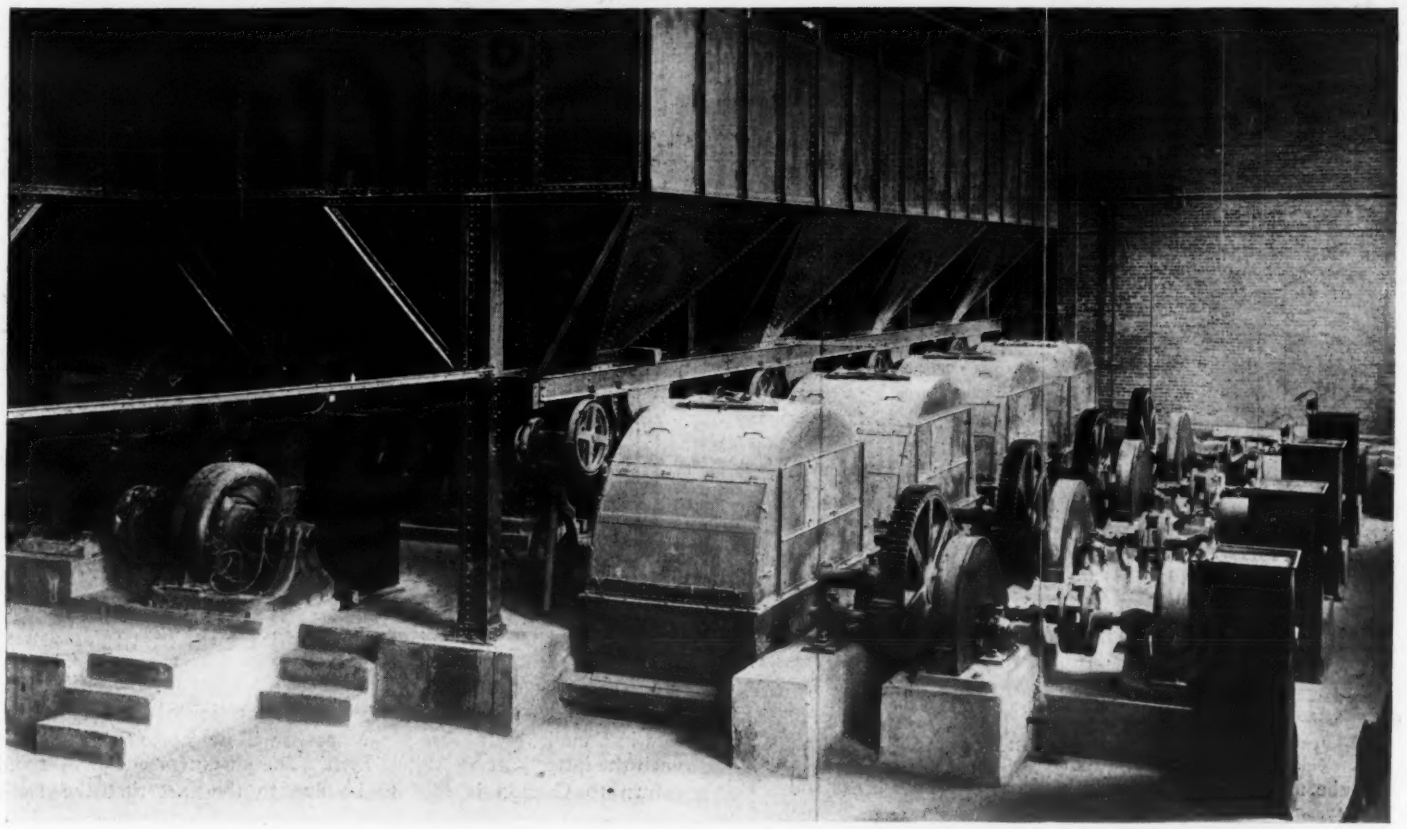


FIG. 8.—GENERAL VIEW OF BALL AND TUBE MILLS.

are hung below the bottom chord of the roof trusses, and are provided with lowering apparatus similar to that generally used for arc lamps. The various machines and tunnels are lighted with single incandescent lights. The wiring throughout the buildings is installed in steel conduit.

The grounds around the building are lighted by arc lamps suspended on iron brackets bolted to the walls of the buildings. The centers of distribution for lighting service are placed at various locations throughout the mills, and are fitted with planished iron cabinets of general design and construction, similar to those described for motors. Each lighting circuit is controlled by a separate switch.

A signal system is provided from various locations throughout the mills, connecting with a signal gong in the engine room for the purpose of signalling to the engine room for cutting in or out current to various feeders.

A fire-signal system is installed throughout the entire plant, connecting the various points with an alarm in the chief engineer's office. A complete private telephone system affords connection between various points throughout the plant, the offices of the company and the private dwellings of the officers. The electrical plant was installed by the D'Olier Engineering Company, of Philadelphia.

A New Laboratory Switchboard Jack.*

BY F. C. CALDWELL.

THE requirements of a good dynamo laboratory switchboard jack may be stated as follows: It should be able to carry its proper current without undue heating or drop; the plug should be so designed that it will be easy to insert and withdraw and cannot be forced so tightly into the jack that it will stick. This latter requirement rules out the taper jack, which is also excluded by the next requirement, namely that the jacks and plugs shall be inexpensive; further, the jack should be such that the plug cannot be unseated by a sideway pull, and it should lend itself readily to multiplication—that is, allow of the insertion of more than one jack in a terminal; the jack should also give a neat appearance to the front of the switchboard, and the part exposed on the front of the board should be easily and cheaply dressed up or replaced in case of burning.

As will be seen from Fig. 1, the jack proper, *A*, consists of a

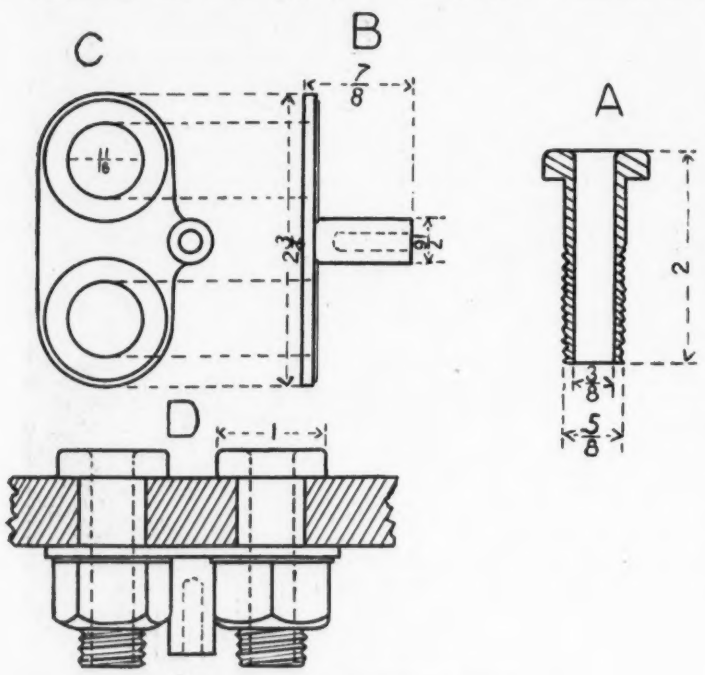


FIG. 1.—DETAIL DRAWING OF JACK.

brass tube made on the turret lathe from one inch brass rod. This is bored and reamed to ⅜ inch, and turned down to ⅝ inch, with the exception of the shoulder which forms the front or exposed end, which is left full diameter and is ¼ inch long. The front edges, both inside and outside, are rounded, and the back end is threaded with a standard ⅝ inch thread for about one inch of its length. This jack tube forms the unit, and any number required can be connected up by suitable yokes on the back of the board. In the laboratory of the Ohio State University the standard yoke is a small brass casting, having two holes for the jack tubes and a lug into which is soldered the wire. This is shown in *B* and *C*, Fig. 1. A standard ⅝-inch iron nut, preferably faced off, is screwed on the back of the tube to hold the jack in the board, as seen at *D*, Fig. 1, where the standard terminal having two jack tubes is shown.

The plug used with this jack is simply a piece of ⅜-inch brass rod 6 inches long, with one end rounded and slit about two inches with a saw; the other end is drilled for the cord, and the plug is

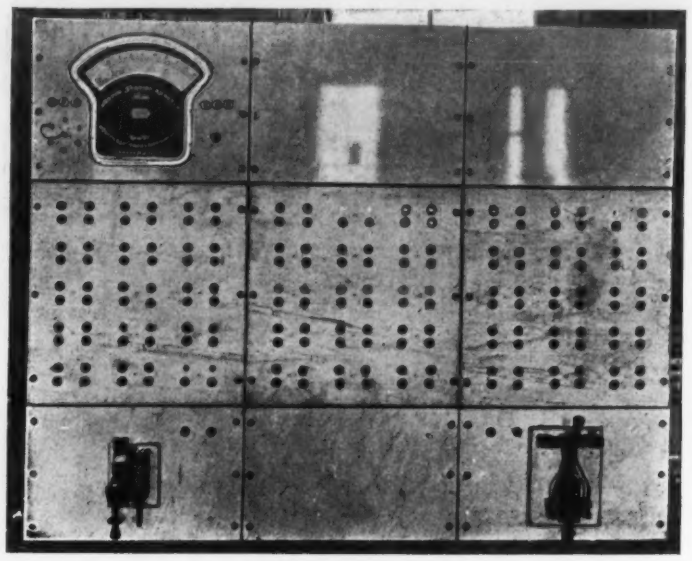


FIG. 2.—LABORATORY SWITCHBOARD.

pinned in a wooden handle with a small screw. To make it more springy it is best to reduce the diameter a little where the plug leaves the handle.

It will be noticed that there is very little machine work on any part of this terminal. The tubes are made very rapidly on the turret lathe, and require no further treatment except reaming out and facing. The yokes require a little facing on the emery wheel and drilling for the wire connection.

As made in small quantities and with cheap labor, the cost of the tubes is about 9½ cents each, of the yoke 6 cents, of the nuts ⅔ cent, and of the plug complete in the handle and ready for soldering in the cord, about 10 cents. Thus a complete terminal with two tubes costs about 26 cents. If made in larger quantities this cost could, of course, be reduced, especially by making the yokes from sheet brass with a die. It is also to be noticed that these jacks are very easy to install in the board, only one ⅝-inch hole being necessary for each jack tube. The tubes are also very readily removed for facing off or replacing, and are very easily smoothed up in a lathe in case of burning. These jacks give a very neat appearance to the board as is seen in Fig. 2, which shows a board fitted with the jacks.

With regard to the current carrying capacity, a test was made by selecting 10 of these jacks which had been in use for several months, connecting them in series with plugs and cords, and sending 100 amperes through them. The highest drop between the jack and plug was .01 volt, the lowest, .002, and the average .006. The heating of the jacks at the end of 15 minutes was hardly perceptible.

* Paper read at the Pittsburg meeting of the A. A. A. S.

Marconi's Transatlantic Experiments.

Mr. Vyvian, engineer in charge of the erection of the Marconi station in Canada, states that Mr. Marconi will not come to Cape Breton until the latter part of August next. The postponement of Marconi's return to Canada is said to be due to the fact that the Italian Government has just placed at his disposal a war vessel, on board of which Marconi will make experiments in long-distance wireless telegraphy. In the meantime it is altogether likely that communication with the station at Cornwall, Eng., will be established by Mr. Vyvian. It is thought that Marconi will go direct to Cape Breton in the Italian warship.

An Electromagnetic Rectifier for Alternating Currents.

BY GEORGE HART MORSE.

THE following experiment is due to a suggestion by the writer. The apparatus was arranged and the experiments performed by Mr. C. R. Cushman, a recent graduate from the Department of Electrical Engineering in the University of Nebraska.

The object to be attained was the division of an alternating current into two unidirectional, pulsating currents, through the medium of a double electric arc drawn between three carbon points, the

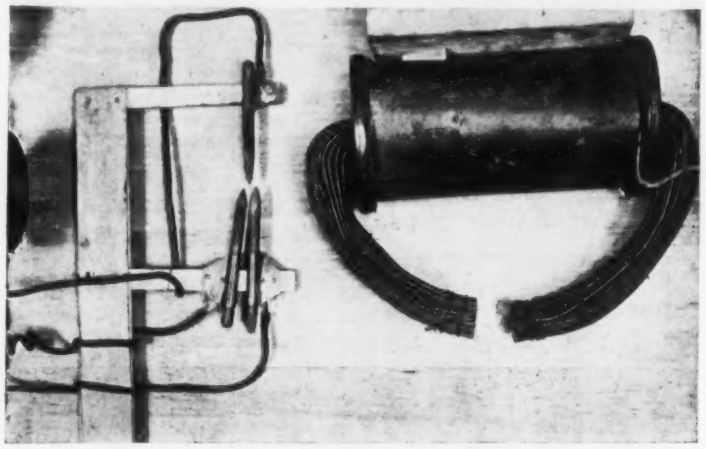


FIG. 1.—ELECTRIC LIGHT CARBONS AND ELECTROMAGNET.

arcs being immersed in a strong magnetic field. To this end three electric light carbons were arranged, as shown in Figs. 1 and 2, the alternating current entering by the lower carbon, Fig. 1, and leaving through two simultaneous arcs established between the lower and upper carbons, respectively. The plane determined by the three pointed ends of the carbons was in the experiments so situated half way between the poles of the large electromagnet, also shown in Fig. 1, that it was at right angles to the line joining the centers of the poles, the arcs being in the strongest part of the field.

The core of the magnet was composed of 56 pieces of very soft iron wire, their average length being three feet, and the diameter of each wire approximately .15 inch. The winding consisted of 1,000 turns of No. 10 copper magnet wire. This magnet was fed with a constant, direct current by means of an independent circuit

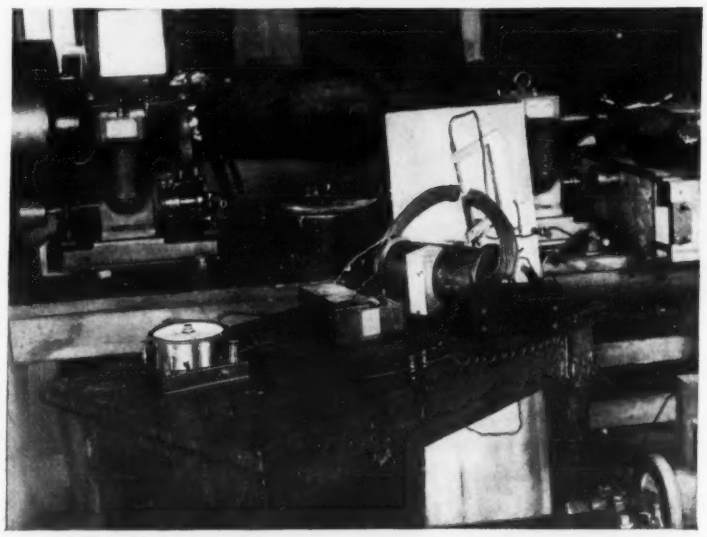


FIG. 2.—EXPERIMENTAL APPARATUS.

provided with a regulating rheostat, *R*, and ammeter, *C*, Fig. 3. For the sake of clearness the magnetic poles are in Fig. 3, indicated as being merely in the vicinity of the arcs, and not at all in the position which was really occupied by them during the experiments.

The alternating current was obtained from one phase of a General Electric three-phase, rotating-field alternator, which was run at such a speed as to produce a frequency of 44 cycles per second. In the lower diagram of Fig. 3, *D* is an alternating-current ammeter of the Hoyt type, whiie *B* is a direct-current Weston ammeter. That the latter was incapalbe of responding to an alternating current was shown by reversing the terminals during the experiment, thus causing the needle to kick off from scale in a negative sense. Any deflection of ammeter *B* would therefore indicate a unidirectional component of the alternating current as circulating through the upper branch in which *B* is located, while it may be likewise inferred that an equal and opposite component is at the same time circulating in the lower branch of the experimental circuit. Since normally before the magnet is energized we would have equal alternating currents flowing in these two paths, assuming that they are

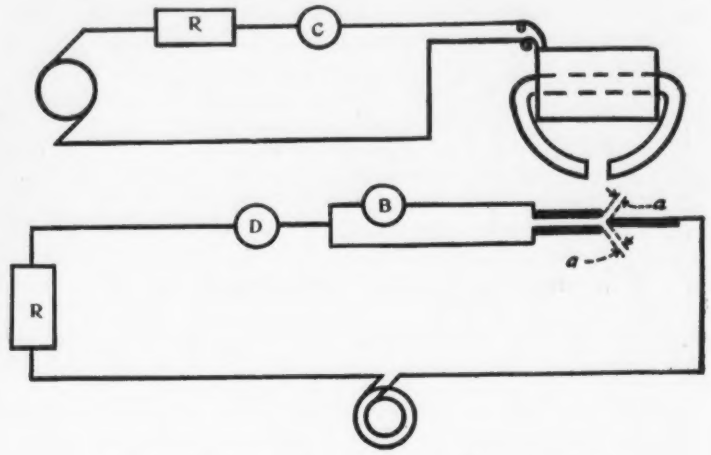


FIG. 3.—DIAGRAM OF ARRANGEMENT OF APPARATUS.

of equal resistance, a reading of *B* equal to half that of *D* would imply, roughly, a complete degree of rectification. This condition was by suitable arrangement acutally achieved, as will be seen from the following experimental results:

Experiment I.

15 *amperes through Magnet*	*Distance a in Inches*	*Reading of Alternating-Current. Ammeter. D.*	*Reading of Direct-Current. Ammeter. B.*
"	.04	30	6
"	.05	28	6
"	.07	25	7
"	.09	22	9
"	.10	20	10

Experiment II.

1.7 *amperes through Magnet*	*Distance a in Inches.*	*Reading of Alternating-Current Ammeter. D.*	*Reading of Direct-Current. Ammeter. B.*
"	.07	32	5
"	.09	28	5
"	.10	25	9
"	.12	22	11

Comparison of the two experiments also show that for the same length of arc, other conditions remaining the same, less alternating current flows while the arcs are affected by the stronger field.

Professor Bell and Wireless Telegraphy.

According to a recent dispatch from Chicago, Prof. Alex. Graham Bell, while passing through that city on his way to Minneapolis, expressed himself in the following language regarding the future of wireless telegraphy: "Wireless telegraphy will never be made practicable for service on land. I believe the invention will supplant the oceanic cables when it is sufficiently developed to be reliable for the transmission of messages, but it can never take the place of the telegraph or the telephone."

Radiant Efficiency of Arons Mercury Arc Lamp.*

By William C. Geer.

THE electric arc between mercury terminals in a vacuum has been known for many years[1] to emit an intense light. Arons[2] first made a form of vacuum tube in which the arc could be easily studied. From the intensity of the emission spectrum it was supposed that the radiant efficiency of this arc would be high. In order to test this idea, the measurements to be described were made.

A mercury arc lamp after the form described by Arons[2] was mounted upon a block of wood which could be tipped so as to make the arc, and connected to a 110-volt direct-current circuit.. The method of measuring the efficiency was the one described by Merritt[4], and frequently used in the Cornell laboratory. Certain modifications in proceeding and calculation were employed in accordance with the deduction of Nichol.[5]

The radiation from the lamp was allowed to fall upon the face of a thermopile, and the first throw of the galvanometer read[6]. This value gives the total radiation A. The throw was then observed with a cell of water interposed between the lamp and the thermopile, giving the reading due to the luminous energy alone, a'. A correction reading for heat transmitted by the water was taken by observing the throw of the galvanometer when a cell of iodine in carbon disulphide was interposed together with the water cell. Calling this reading e', then, acording to Nichols,

$$\text{efficiency} = \left(1 - \frac{e'}{a'}\right)\frac{a'}{A'}$$

Considerable difficulty was experienced at first owing to the frequency with which the lamp went out. This happened most often when running with low currents. There was no way that this could be remedied. In order to be sure that all readings were observed when the lamp was burning, a small mirror was so mounted near the galvanometer that the light from the lamp was reflected into the free eye. In this way the extinguishing of the lamp was recognized. It was thus necessary to repeat until readings were obtained with the lamp burning throughout the time of the throw.

Another more serious difficulty was due to the fact that the glass of the lamp became highly heated by the arc. Thus the total radiation readings do not represent the real total energy from the arc, but rather the energy from the arc plus considerable energy from the heated glass. To overcome this difficulty and obtain readings which would be proportional to the energy of the arc alone, several devices were tried. None of them gave complete satisfaction; by far the best, however, is with the use of a chronograph in the following manner:

With the iodine and water cells removed, as soon as possible after striking the arc the screen was drawn away and the first throw of the

Table I.

Time Seconds.	*Throw.*	*Reciprocal.*
0	4.36	0.98
99	2.12	0.472
192	1.56	0.640
257	1.30	0.769
320	1.13	0.885
377	1.02	0.980
453	0.92	1.088
507	0.82	1.220

galvanometer observed. At the instant this reading was obtained the key was pressed, thus simultaneously extinguishing the lamp, by breaking the circuit, and recording the time of the observation by means of the chronograph. This latter instrument was actuated by a chronometer which was marking two second intervals.

While the lamp cooled several successive throws were observed, the time being recorded at the instant of each throw. By this means a time curve of cooling of the hot glass was obtained which, when exterpolated back to the zero time—in this case the ordinate axis—indicated the throw proportional to the energy of the hot glass on the instant that the lamp was extinguished. The difference between the exterpolated reading and the one actually read gives the energy due to the arc alone, which was the value desired. On plotting the reciprocals of galvanometer throws as ordinates and time as abscissas, the curves proved to be straight lines, which fact simplified the exterpolation. One illustration will suffice. The exterpolated reciprocal value is 0.296. The corresponding throw is 3.38. The difference 4.36 — 3.38 = 0.98. The efficiency or $a'/A = 0.448$. The efficiency corrected, or $(1 - e'/a')\ a'/A = 0.427$.

Table II.

Volts.	*Amperes.*	*Efficiency.*
14.3	3.85	0.305
14.7	5.02	0.419
14.4	6.03	0.458
14.6	7.09	0.406
14.5	8.11	0.438
14.7	9.04	0.479

The results are given in the Table II. The discrepancy between the values is doubtless due to the extreme unsteadiness of the arc, which could not be overcome. They indicate on plotting efficiency as ordinates against amperes as abscissas, that a proportionality exists between the efficiency and current.

* Paper read at the Pittsburg Meeting of the A. A. A. S.
[1] Way. *Dingl. Polyt. J.* 157, 399 (1860).
[2] Arons, *Weid. Ann.* 47, 767 (1802).
[3] Arons, *Weid. Ann.* 58-73 (1896).
[4] Merritt, *Am. J. Sci.* 37, 167 (1889).
[5] Nichols, *Phys. Rev.* 11, 215 (1900).
[6] Merritt, *Am. J. Sci.* 41, 41 7(1891).

The Trend of Progress of the Prime Movers.

FOLLOWING is an abstract of the paper read by Prof. R. H. Thurston at the Pittsburg meeting of the A. A. A. S., and referred to last week in our report of the proceedings:

The great prime movers have been known in type, and in some cases in specific forms still familiar, since the days of Hero, of Alexandria, and, probably, may have been in some forms known to prehistoric Greeks and Asiatics. The sources of power—heat, falling waters, the winds—all were well known when the earliest scientific writings were produced, and the famous Alexandrian "museum" contained illustrations and examples of even some of our simpler familiar types of steam engine and steam boiler.

The prime movers made little progress toward their present perfection until the commencement of the eighteenth century when the steam engine of Savery and Worcester—the old steam-fountain of Hero the Younger—was displaced by the modern steam-engine, a real train of mechanism, devised by Newcomen, the inventor of the modern type of machine, about 1707. Meantime, water-wheels and wind-mills were taking form, and the prime movers thus were preparing to do their part in the world. Improved by Watt, the steam engine assumed the largest part of the load, but the water-wheels and windmills have always done a large amount of work in the aggregate. The industrial world came after a time to be moved as a whole by the prime mover of Watt, and steam power has of late performed vastly more work than could the whole population of the world, unaided.

The gas engine has a history of about the same length as has the steam engine in its form of a prime mover for mills. It was introduced about a century ago and has progressed meantime less rapidly than its rival, but since the middle of the last century its advance has been steady, both in construction and in employment. To-day, this motor has assumed a perfection of design and construction, and has attained an excellence of economical performance, which is rapidly bringing it into use in a great variety of fields, and is, in fact, making it a promising competitor with the older motor.

The other motors have been meantime greatly improved. The modern hydraulic turbine has attained an efficiency of 80 per cent. and upwards, and the contemporary windmill is a scientifically designed and skilfully made apparatus of but little if any less perfection for its purpose or efficiency in utilizing its form of energy. All the common forms of prime movers have now, thanks to advances in sciences related to engineering and to the progress of invention, become highly perfected, and the next question of the engineer and of the employer of power has come to be: "What new motor can be devised to more perfectly utilize the available energies of Nature?"

The serious wastes of the best of heat-motors are doubly serious and important in view of the fact that our coal deposits are of limited extent, and that, however, great they may appear, that limit will be attained in one-fifth the time, even with the best practice of to-day, that would be secured could the wastes, now apparently inevitable, be extinguished. Our best steam and gas engines waste four times as much of the thermal energies supplied them as they utilize. A substitute for these engines must be sought

if they cannot be made thus practically perfect; but no way is known by which the purely thermodynamic wastes which constitute the greatest obstacle can be avoided.

Our existing stores of available energy may possibly be reinforced by more complete employment of the water powers, the wind currents and the internal heat of the earth. Our present wastes of thermal energy might be reduced to comparative insignificance could a way be found of imitating nature in the complete utilization of the supply through other processes than thermodynamic. Nature actually does produce light without heat, and, apparently, at least power without thermodynamic wastes; it would seem that man should be able to imitate her methods. If this could be done, our electric lighting could be provided, or a substitute of similar value obtained in a way that should reduce the wastes, as in the firefly and the glow-worm, with one four-hundredth as much expenditure of energy as now is exacted in the production of light by our usual forms of illuminant. It would be possible to increase the amount of power derived from a stated quantity of potential energy four or five times. Heat drawn from the interior of the earth would provide us with what may be needed by man as long as man can live upon a cooling globe.

When the inventors and discoverers have thus performed their task, we shall be assured of a vastly longer persistence of civilization upon the globe, shall be able to employ mechanical power at a fraction of its present cost, shall secure light without heat, and of a hundred times greater quantity at the same expenditure, shall distribute the electric current for whatever purposes at minimum expense and shall make every civilized nation on the earth many times wealthier, and shall extinguish poverty and, largely, crime.

The Telephone Situation in the Northwest.*

BY C. H. JULSON.

Independent telephone companies, Mr. Judson stated, began operations in Minnesota as early as 1893, when two or three venturesome individuals established exchanges in towns lying at a considerable distance from the commercial center of the State. These exchanges were not in competition and were soon connected with the Bell systems under traffic arrangements. He then went on to describe the work done at first by irresponsible promoters, who had, however, now disappeared from the scene, leaving good and earnest independent companies engaged in reconstruction and extension.

The field in Minnesota and the two Dakotas has been a good one for the independents, since the Bell Company, operating in these States, owns a comparatively small number of exchanges, perhaps not to exceed sixteen in all. It was found that if a good independent exchange were built along the route of the Bell Company's long distance lines that the Bell people were immediately anxious to secure connections with the new exchange. This, of course, helped to encourage the independents very greatly, and while the Bell Company has built no new exchanges in the States mentioned within the last five years, every town of five hundred inhabitants or more has a telephone system, some of them reaching to the important centers near them over independent lines exclusively, and some part of the way over independent lines and part of the way over the Bell lines. The policy of the Bell Company being to absorb the lion's share of the receipts, the arrangement has not been altogether satisfactory to the independents, and new toll lines have been constructed giving strictly independent connections with the largest independent exchanges from the outlying districts. Other lines are planned for construction during this and the coming season which will give the center of distribution, that is, the twin cities of Minneapolis and St. Paul, close connections with all points in the States of Minnesota and North and South Dakota and will link the splendid system of the Wisconsin independents to it, making a Northwestern independent system capable of holding its end of the competition.

From the report of President Vallentine of the Wisconsin Association he quoted the following statistics as to the independents in that State: Exchanges, 137; copper metallic toll lines, 200 miles; iron metallic toll lines, 3,000 miles; iron grounded toll lines, 4,000 miles; toll stations, 650; telephones in use, 23,000; invested capital, $2,316,875.

From the fact that the Minnesota Association has just been organized it has been impossible to gather complete statistics regarding the business in that State, but from present information they are as follows: Exchanges, 147; miles of long distance toll lines, 4,000; miles of circuit, 7,000, of which 1,150 miles are copper metallic; toll stations, 725; invested capital, about $3,300,000; telephones in use, 34,000.

South Dakota shows 103 exchanges, 2,350 miles of toll lines, 450 toll stations, and North Dakota 89 exchanges, 1,875 miles of toll lines, carrying 2,750 miles of circuits and 350 toll stations.

This showing is indicative of the enthusiasm which prevails in the Northwestern States regarding independent telephony. Since the Bell Telephone Company came into control of the Northwestern Telephone Exchange Company and the Wisconsin Telephone Company, their licensees in that territory, it has been endeavoring to tie up as many as possible of the independent exchanges under the Bell license contract, by the terms of which the exchange company agrees irrevocably to sell to the Bell. Very few of the independent exchange companies have signed this contract. They hold the situation in their own hands as the long distance connections are of far greater importance to the Bell Company than to them; they are firmly maintaining their position and closing no contracts which will bind them to the Bell corporation. In the natural order of events the Bell Company will make extraordinary efforts to get hold of many of the larger independent systems, since, if they are cut off from them, they will lose very valuable connections in future. Were the independents in a position to duplicate on short notice the six trunk lines running in various directions throughout the State of Minnesota and into the Dakotas, the Bell people would find themselves without feeders in almost the entire territory, so that it is very clear why they should make the most extraordinary efforts to tie the independent people to them. There is little danger as matters stand at present that such a consummation will come to pass unless inducements far out of the ordinary are made. In any event, however, the money received would probably be reinvested by the independent who sells out to the Bell in an opposition plant, giving him in all probability a better exchange and toll line system than he had before.

The largest independent company in the northwest is the Twin City Telephone Company, operating exchanges in Minneapolis and St. Paul. This company entered the field in 1898 under the name of the Mississippi Valley Telephone Company. In 1901 the name was changed to the Twin City Telephone Company and a new organization and ownership effected. The plants of the Twin City Telephone Company in the two cities are in active competition with the Bell and are giving a quality of service which probably cannot be excelled in the country. The construction, both aerial and underground, is of the very best, the equipment is of the most up-to-date and efficient pattern and great care has been exercised to procure only the very best material and apparatus in all of the work.

A large portion of the work in both cities is underground, vitrified clay conduit being used exclusively, something like 1,000,000 feet of conduit being now in. The cable used runs from 200 pairs down built on the very best specifications, all being No. 19 B. & S. G. double wrap.

The pole lines of the Twin City Telephone Company are probably the handsomest to be found in the country, Idaho and Washington poles having been used for the most part and painted uniformly.

The plant of the Twin City Telephone Company comprises seven exchanges in the cities of St. Paul and Minneapolis, the company owning four of its own buildings, all having been constructed within a year, and each being built especially for the purpose in the most convenient and substantial manner. The extraordinary amount of territory covered by the Twin City Telephone Company renders the branch exchange system a clear necessity and the trunking service between the different exchanges has proven very satisfactory. The total ultimate capacity of the switchboards which are now installed is about 26,000 in the two cities. New switchboards will be installed next season, adding five or six thousand ultimate.

The growth of the Twin City Telephone Company's business

* Abstract of paper read at the Philadelphia Meeting of the Independent Telephone Association of the United States.

has been along the same lines as of all other independent companes and has even surpassed the expectations of those who are familiar with the demands which might be made upon them. Nearly 7,000 telephones are now in operation in Minneapolis and St. Paul and orders are being taken and installed at the rate of over 500 per month. The Twin City Telephone Company installs no party lines, and it is therefore for the present cut off from doing business with a large number of the subscribers of the Bell Company who can afford to pay but little for a telephone. This, however, has no effect on its earning power nor upon its business prospects, since the telephone user who must get along with a telephone at a dollar and a half a month is of comparatively little importance in the business field. The company has installed a large number of private switchboard systems and has been compelled to maintain a separate department for the installation and care of this particular branch of the work. The company has invested over $2,000,000 in the Twin Cities up to the present time.

The Zenith City Telephone Company of Duluth is the second largest independent telephone company in the State of Minnesota. It commenced construction in 1899 and at that time the Bell Company in Duluth had 700 subscribers. At the present time the Zenith City Telephone Company has about 1,900 subscribers in Duluth and it is unable to keep pace with the demand. Closely allied with the Zenith City Telephone Company is the People's Telephone Company of West Superior, Wisconsin, which began business at the same time and has been as prosperous as the Zenith City Company.

These two companies are connected with the Twin City Telephone Company of Minneapolis and St. Paul by a long distance line carrying three No. 10 copper circuits. This line belongs to the Consolidated Telephone and Telegraph Company, a corporation composed of officers of the Twin City Telephone Company. This connecting line is doing a good business and must have made some impression on the American Telephone and Telegraph Company, which it parallels, since immediately upon the completion of the consolidated line the American Telephone and Telegraph charge was cut from 75 cents between the Twin Cities and the head of the lakes to 40 cents, the Consolidated Company having made its rate considerably lower than the old rate. The company is doing a very satisfactory business and has some 28 stations on its line, which is about 150 miles long, the through business between the head of the lakes and the Twin Cities being especially good.

The Consolidated Telephone and Telegraph Company has material on the ground for the construction of a line between St. Paul and Eau Claire, connecting at that point with the Wisconsin system and running directly into the exchanges in Eau Claire, Menominee and Chippewa Falls, Wisconsin; also a line running southeast along the river to La Crosse, Winona and intermediate points, perhaps thirty in all. This line will feed a large number of lines which have connections with the Twin Cities and will probably get 100 toll stations and 25 exchanges off of these lines. 1903 will see the Consolidated Telephone and Telegraph Company's lines extended southwest and west and northwest into the territory which is now connected with the Twin Cities only by Bell lines. These lines will be of the very best copper construction.

The United Telephone and Telegraph Company, with headquarters in Minneapolis, operates about 250 miles of line running southwest and south from St. Paul, with connections with the Twin City Telephone Company. These lines pass through three of the largest towns in which the Northwestern Telephone Exchange Company has exchanges, and in each of these towns an independent exchange is doing a successful business. One of these cities, Mankato, Minn., is rebuilding its entire plant this season, installing a new lamp signal switchboard, and putting in considerable underground construction. The Winona Telephone Company is also very successful, and the La Crosse Telephone Company is well known to be one of the pioneers in the independent field and is doing remarkably well. Perhaps the most successful independent in Wisconsin is the Madison Company.

Farmers' lines in Minnesota are taking hold in good shape, one company having over 400 farmers connected with its lines and increasing its plant constantly. Parts of Wisconsin and Minnesota are as good farmers' line territory as can be found in the country, while other portions, of course, are so thinly settled that it will be some years before much is done along this line.

At the meeting of the Minnesota independents recently held in Minneapolis, the constitution adopted contained an important clause and one worthy of mention at this time. It particularly provides for the elimination of poor construction and the building of toll lines and exchanges in the best possible manner, standardizing the work to the greatest possible extent. The independent owners in Minnesota have found that poor construction is not satisfactory from an investment standpoint and this agreement is certain to give the business in our territory a solid basis for future calculation and a standing among the independent systems of the country.

Portions of the Northwest demand telephone service because of the long distance between railroad stations and their inaccessibility at certain seasons of the year. In these districts it has been found difficult to make a good line pay at present, but the telephone has been found to be an active agent in the settlement and building up of a new country, and men of means and energy are at hand to furnish, next to transportation facilities, the most valuable adjunct to frontier and backwoods settlements. Fortunately many of these districts supply plenty of good cedar poles immediately at hand, making the construction to a great degree cheaper than in the more settled districts. The telephone is so important to every class of business and to every kind of community that no one is willing to be without it, even the Indians on the reservations, among the more educated ones, finding the telephone to be of some use to them, since the farmers among them have learned that if they have anything to sell, they are certain to get better prices where they can ascertain what the markets are at the centers of trade.

A High Potential Direct-Current Plant for Experimental Work.*

By G. S. Moler.

In order to have a direct-current potential of about twelve thousand volts available for experimental purposes it was decided by Dr. E. L. Nichols, professor of physics, and Harris J. Ryan, professor of electrical engineering in Sibley College, of Cornell University, that they would purchase jointly a large number of small high-potential, direct-current dynamos, and after thoroughly insulating them from each other, connect them like battery cells in series so as to obtain a potential equal to their added pressures. Such a set of dynamos was obtained and have been mounted in a suitable manner by the writer, making a high-potential plant which has proved satisfactory in its workings.

In this plant 24 direct-current separately-excited dynamos of 500 volts each have their armatures connected in series so that a pressure between the terminals of the series is given which is equal to the sum of the individual pressures of the dynamos, this sum being from 12,000 to 14,000 volts, depending upon the speed and the degree of excitation. The full-load current for which they were constructed is .22 of an ampere. For excitation purposes they are divided into three groups of eight each, which have their fields connected in series and to these the terminals of a 170-volt exciter is connected.

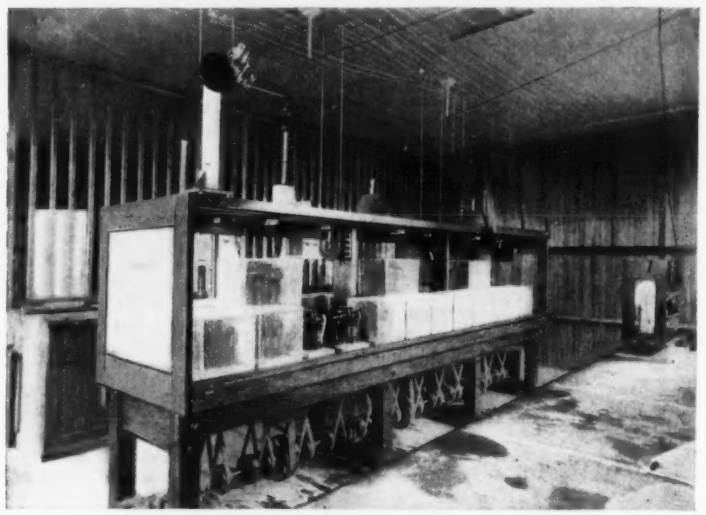
Three similar exciters with controlling rheostats are used. The dynamos and exciters were constructed by the Crocker-Wheeler Company, of Ampere, N. J., especially for this use, great care being taken in highly insulating them so that they would not break down under the enormous strains to which they might be subjected. It was assumed that the terminal pressure of 4,000 volts in a group of eight would not be sufficient to cause a leap from one terminal brush to the frame, then to the field wire and from that again to the frame of the eighth and to its brush, thus short-circuiting the group through their fields and through the exciter. To further insulate their frames from each other they were placed upon individual slabs of polished dark Tennessee marble, and the wires from the brushes and those from the fields were carried down through glass tubes placed in holes drilled through the marble. The dynamos and exciters are all driven from the same countershaft by means of leather belting. It was thought that the leather would afford ample insulation between the frames of the machines, so no additional precautions were taken to insulate them from the countershaft. A massive table or frame-

* A paper read at the Pittsburg meeting of the A. A. A. S.

work of white pine was constructed and was stained, then it was coated with hot linseed oil, which was allowed to dry for several days, after hich it was thoroughly varnished with shellac.

The table was constructed so that the dynamos could be mounted in two rows upon it. In each row they are placed one to each foot in length of the table, and in one row they are set a little ahead of those in the other row, so that their belts will not interfere upon the countershaft, which is placed between the legs of the table and near the floor. The exciters are placed upon raised platforms between the rows, as can be seen in the view. The rheostats shown near the exciters have grooved wheels and are operated by means of cords extending to one side of the room. The top of the table is not solid, but consists of four longitudinal planks placed edgewise, supporting the ends of the two rows of small marble slabs. The slabs are about seven inches wide, thus leaving about five-inch spaces down through which the belts are carried. The counter shaft is belted to an electric motor.

Over each machine is placed a galvanized wire netting cage and this is connected to the upper brush to keep it of the same potential as that brush; the adjacent cages, therefore, have a difference of potential of 500 volts. These are to protect the dynamos from any induced discharges which may take place among them. In the view two of the cages have been removed. A glass case with doors hinged at the top encloses the whole of the upper part of the table. The wires from the terminal dynamos are carried through porcelain tubes up through the top of this case, one of them to the circuit breaker, and each to an oil-break switch.



HIGH-POTENTIAL DIRECT-CURRENT PLANT.

The circuit breaker shown on the left-hand end of the case has a long arm hinged at the top; this is actuated by means of a spring, so that when it is released from the catch at the bottom it flies upward, thus making an 18-inch gap in the circuit. The flash takes place between two pieces of carbon. The arm is latched again by revolving the wheel shown at the top of the circuit breaker, the wheel also opens the oil-break switch before it latches the arm of the circuit breaker. The core of the solenoid of the circuit breaker has been adjusted to jump up with .24 of an ampere. The oil-break switch consists of a plunger immersed in oil but held up by means of a spring unless it is pushed down against the contact plate in the bottom of the oil reservoir by an arm extending outward from the wheel of the circuit breaker. When opening the oil-break, the plunger follows the arm to the limit of its path then the arm leaves it, making an 18-inch gap in the circuit. In this way the wide gap is made without swinging through space an arm which is dripping with oil.

At the farther end of the case the second oil-break switch is located; it is also operated by means of a wheel, and these wheels are both turned by means of cords extending to the side of the room. A cord to open the circuit of the driving electric motor extends to the same place. These cords are all for the purpose of enabling the operator to make the proper adjustments without exposing himself to the high-potential current.

The wires from the oil-break switches are carried to insulators, which consist of long porcelain tubes suspended from the ceiling of the room; screwed into plugs in the lower ends of these tubes are screw eyes, through which the wire is carried.

In the preliminary test of the apparatus each little dynamo was run alone, and its brushes were connected to two 250-volt incandescent lamps which were joined in series, and at the same time the exciter was connected to the eight field circuits of that group to which the little dynamo belonged. In this way the brushes were adjusted before the cages were placed over the machines.

After these adjustments were made, the individual groups were tried to note the effect of changing the rheostats of the exciters. A Klvin electrostatic voltmeter having a range of 20,000 volts was used to denote the pressures obtained.

The circuit breaker was found to work promptly under all conditions of overload, the severest test being suddenly to short-circuit the terminals at the voltmeter. In this case a thick flame, nine or ten inches long, would be drawn out by the moving parts as the gap was being widened. A rough test of the jumping distance of the current at 12,000 volts was made by bringing the blunt ends of two No. 14 B. & S. gauge copper wires near to each other, these wires being connected to the leads near the electrostatic voltmeter. When the space was reduced to about 16 mm. an arc was suddenly formed, which lasted till the circuit was opened by the circuit breaker. With 14,000 volts the space was about a millimeter longer.

The plant was run in the dark to observe the brush discharge that might take place around the small dynamos or from any part of the circuit and connections. A feeble glow could be detected at the ends of the leads, especially when they were almost near enough for the current to leap across; also a glow was detected around some of the connections, but around the brushes and the dynamos themselves none could be seen for the reason that the sparking commutators gave considerable light.

Each little dynamo appears to operate just the same as if it were entirely alone, so it would seem that another similar set might be connected in series to the present one with a considerable degree of confidence that they would operate successfully together.

Hand vs. Machine Telegraphy.

BY JOSEPH B. BAKER.

I HAVE read with astonishment Mr. Barclay's letter in the ELECTRICAL WORLD AND ENGINEER of July 5. Apart from the ultroconservatism of the views expressed on the merits of systems for rapid machine telegraphy that have been designed for American lines and conditions by the best brains in electrical America, and apart from the relegation of the designers of such improved systems to the ranks of college professors, interested inventors and promoters, it seems to the writer that Mr. Barclay's letter is merely a defence of the operating methods of his telegraph company, and limited to a presentation of a series of issues aside from the real fundamentals of the subject, "Hand *vs.* Machine Telegraphy." It is not the writer's wish to reply to Mr. Barclay or to controvert the points in his communication referring to existing telegraph operating practice. He desires, however, to present some broad considerations more directly related to the heading of this article.

In the early days of the Morse telegraph in this country, hand working was a wonderful thing enough. It was realized by the public that the extension of so new an art necessarily carried with it what might be called an emergency charge for telegraph service. The use of the telegraph came to be regarded as a sort of luxury, only to be resorted to when the urgency of the intelligence to be transmitted outweighed all questions of cost. The property of the single telegraph operating company, and latterly of the two large companies in possession of the field to-day, has consisted largely in "rights of way," which mean possession of the field and the discouragement of all genuine competition. The growing conservatism inherent to an enormous business carried on under monopoly conditions made it easier, as the business of the country increased, to add wires on existing pole lines than to experiment with systems of operating designed to be an improvement over the "key and sounder." Furthermore, some difficulties in the way of the American working of such foreign systems as the Wheatstone seemed to constitute a precedent against any innovation tending to displace manual telegraph operators, trained in the first instance to the reading of the Morse tape, and later to the reading of the Morse sounder. The lines could always be made to fill nearly, or quite, the demand for the expensive and infrequently resorted to "telegram," so, with a few unimportant ex-

ceptions, hand operating has persisted until the present time, both for heavy traffic between large cities and for local messages; all messages having to pass through the crude process of being clicked off by the hands of operators more or less expert.

In further considering this situation in comparison with the possibilities of machine telegraphy, the question arises: What is manual telegraph operating? In the case of a line from New York to Chicago, it is the exclusive holding of a 984-mile line by one man while he opens and closes his key by hand, spelling out the message, to be as slowly and laboriously interpreted and written at the other end. The introduction of repeaters does not affect the truth of this broad statement, and the use of the quadruplex only multiplies the virtual speed of transmission by four, although regarded in its day as a very great improvement. The operating of the key at the transmitting end is practically the subjecting of the long line wire to a series of electrical blows, by, so to speak, whacking a battery on to it as one might pound the end of a rail in Morse characters, to be read by a distant receiver with his ear to the track. The individual signals travel with the speed of electricity, but the length of each signal and the spaces between them answering to indentify the groups of signals as letters of the alphabet make this process singularly slow compared with the nature and capabilities of the agent, electricity, by which the impulses are transmitted.

To cut short the description of the, electrically speaking, painful and clumsy process of manual sending, it is the limiting of the hundred-fold carrying capacity of the wire (realizable by existing methods of applying a rapid series of impulses proper to the line) to the output of one man's hand moving scarcely faster than a pen can be driven. The "harnessing of electricity" to this, electrically speaking, pitifully slow pace, is as out of date, as jarring with the spirit of the age, as an ox team.

When the telegraph was invented, and, indeed, for as long as the people were content with merely improvements on the methods of their fathers, the apparent instantaneousness of the signal—the response of the sounder simultaneous with the closing of the key—was a wonder, awe-inspiring, and more than satisfying. But the present-day demand is for quickness of transmission, not of the individual signal, but of intelligence—not the crude manipulation of wires in order to deliver a few thousand messages at a rate that makes the average man think of the expense at least one and one-half times before sending one, but the scientific use, to the full, of an agent whose powers it is absurd to compare to or limit by hand labor. This present day is too busy a one to do things in slow and painful ways. If one travels, it is by train, at twice the speed all day of the fastest horse for a single mile; the walk or ride from the station to one's home is the local exception to the train that proves the rule of the train's essentiality to modern life. If a city newspaper is to be printed, its tens of thousands of copies every issue can only be turned off by giving practically the whole contract, from type-metal to folded newspaper, to a set of machines; the fact that hand-bills are printed slowly on a laborious "printing press" is a local fact that only serves to show forth the essentiality of a linotype and a Hoe. Whenever there exists a large aggregate of purely mechanical movements, the time is at hand when any further growth in the number of such movements, whether they spell manufacture or traffic, means that machines must be employed—there is no alternative but the raising of prices of manufactured article, or rate for traffic, respectively.

This brings us to the root of the particular issue under discussion—"Hand *vs.* Machine Telegraphy." The operating companies of this country have been able to exercise the conservatism that grows with private monopoly, and is necessarily tended and nurtured by it. They have acquired and become firmly intrenched in their "rights of way." With the enormous material growth of these United States has come the corresponding growth of the need of facilities for the transmission of intelligence. The mail service is one of these facilities, and with the growth of its traffic has been able to reduce its "rate for messages"; letters being carried for one-third less than formerly, under improvements that have made the 2-cent stamp possible. The postal rate was reduced not only actually but relatively, because sway was given to the law of reduction of cost with increase of output of traffic. The same remarks are broadly true of the express service.

But now consider the telegraph service. The rates have been reduced from time to time, under pressure of a sort of competition, imperfect and not free to make for the public good to the limit; but the reduction of rates has not been such, had not been allowed to become such, as would require, in order to maintain dividends, an increase of traffic at all corresponding to the need of instantaneous communications by the business world. If the telegraph monopoly were less impersonal and had a voice, one could imagine it to say: What is the use of benefiting the public, *per se,* when by the maintenance of the present rates we can still handle the business by hand labor? Mr. Barclay tells us that rates are even higher abroad. That means, it is even more expensive and difficult to send telegrams there than here, as he sets forth in several comparative examples. In the same way, it becomes more difficult to send telegrams when a blizzard causes a loss of two-thirds of the wires between Boston and New York; hand operating, with or without the quadruplex, over the remaining good wires accentuates the general absurdity of hand operating by the spectacle of the business communities of both cities waiting for hours for the operators to click off their messages.

It is not at all a question of the best business and operating methods of electrically transmitting intelligence at an emergency cost to the public, prohibitive of all messages, but those where the urgency becomes the ruling factor; it is, as the writer views it, a broad question of whether machine telegraphy would serve the public better, or hand telegraphy does serve the companies easier. It is idle to assert that machine telegraphy is a college professor's dream, aside entirely from the propriety of so contemptuous an allusion. It is idle to maintain that electricity cannot be made to work a machine at least as fast as the typewriter, which, in the hands of a mere novice at the sounder, can easily keep up with the fastest manual sending ever executed; and, at that, leaving all the added speed capacity of the machine, as a machine, untouched. It is merely an issue with the everyday facts to say that the capacity or other attenuating properties of the line inhibit rapid machine telegraphy; to cite the telephone current, doing its work perfectly by an alternating current whose mean frequency is in the neighborhood of 2,000 alternations per second, and traversing long and electrically difficult lines, is a sufficient answer. It is a patent fact, of which it would be almost impertinent to remind well-informed electricians, that there are in existence several complete systems of rapid telegraphy, any of which at its very worst disadvantage shows the manual method of handling heavy traffic to be just what it is at its best, in the hands of clever operators with brains and endurance: slow, clumsy and inadequate.

Metered Telephone Charges.

By M. J. Wohl.

THE subject of telephone metering has been discussed repeatedly, but up to the present the flat rate of charging has kept the lead. It has been pointed out that an exchange as its business increases gives poorer service, and the annoying cry of "busy" becomes augmented. To reduce this often-repeated cry, "busy," is the object to strive for, and as soon as that ceases the list of subscribers will increase.

It appears that a system of charging on an *average time basis* would tend to correct all difficulties. For instance, if the time spent in all calls from the moment the called-up party responded, until conversation ended, was added together and the total thus obtained, divided by the number of calls charged for at a predetermined price per minute, it seems without doubt that the subscriber would aid the central in making better and more rapid connections.

For example, say that the telephone company charges on an average for one minute calls, 2 cents; two minutes, 3 cents; three minutes, 4 cents, and so on, and that a subscriber has a meter which records all actual calls and time spent on each of them. If the meter records, after the expiration of say 30 days, 70 calls, and sum total of 280 minutes, the average would be four minutes, and at the rate of 5 cents per call the charge would be $3.50. Or suppose that the meter reads 25 calls and 175 minutes, or 7 minutes per call, for which the charge would then be at the rate of 8 cents, or a total of $2.00.

It would seem that such a method or a similar system of charging, where the subscriber is encouraged to use the telephone oftener, and for short intervals, should meet with the telephone company's approval. It would not only tend to increase the speed in making connections and leave open lines for communication, but the price would encourage persons to use the telephone where now they often times use the mails.

New Marconi Wireless Telegraph Apparatus.

In his recent Royal Institution lecture, reprinted in these columns, Mr. Marconi announced a new form of magnetic detector of electric waves, which can be employed as a receiver for space telegraphy. In a paper presented June 12 before the Royal Society a fuller account is given of the principles of this new apparatus, which we reprint below:

The present note bears upon the special manner in which a core or rod of iron or steel placed in a varying magnetic field is affected by high-frequency oscillations transmitted from considerable distances.

The magnetization and demagnetization of steel needles by the effect of electrical oscillations has long been known, and has been noted especially by Professor J. Henry, Abria, Lord Rayleigh, and others. Mr. E. Rutherford also has described a magnetic detector of electric waves, based on the partial demagnetization of a small core composed of fine steel needles, previously magnetized to saturation, and placed in a solenoid of fine copper wire connected to exposed plates. By means of a magnetometer Mr. Rutherford succeeded in tracing the effects of his electrical radiator up to a distance of three-quarters of a mile across Cambridge.

The detector about to be described is based upon the decrease of magnetic hysteresis, which takes place in iron when, under certain conditions, it is exposed to the effect of high-frequency or Hertzian waves. As employed up to the present, it has been constructed in the following manner:

On a core or rod, consisting of thin iron wires, are wound one or two layers of thin insulated copper wire. Over this winding, insulating material is placed, and over this again, another longer winding of thin copper wire containing a narrow bobbin. The ends of the winding nearest the iron core are connected to the plates or wires of the resonator, or as is the usual practice in long-distance space telegraphy, to earth and to an elevated conductor; or they may be connected to the secondary of a suitable receiving transformer or intensifying coil, such as are now employed for syntonic wireless telegraphy. The ends of the other winding are connected to the terminals of a telephone or other suitable receiving instrument. Near the ends of the core, or in close proximity to it, is placed a magnet, preferably a horse-shoe magent, which, by a clockwork arrangement, is so moved or revolved as to cause a slow and constant change, or successive reversals, in the magnetization of the iron core.

It has been noticed that if electrical oscillations of suitable period be sent from a transmitter according to the now well-known methods, rapid changes are effected in the magnetization of the iron wires, and these changes necessarily cause induced currents in the windings, which induced currents in their turn reproduce on the telephone with great clearness and distinctness the telegraphic signals which may be sent from the transmitting station. Should the magnet be taken away, or its movement stopped, the receiver ceases to be perceptibly affected by the electric waves, even when these are generated at very short distances from the radiator.

This detector has been successfully employed for some time in the reception of wireless telegraphic messages between St. Catherine's Point, Isle of Wight, and the North Haven, Poole, over a distance of 30 miles, and also between Poldhu, in Cornwall, and the North Haven, over a distance of 152 miles, of which 109 are over sea and 43 over high land. It has also been ascertained that signals can be obtained over these distances with the new detector when employing less power at the transmitting station than is necessary if a reliable coherer be substituted for the magnetic detector. It has been noticed, however, that the signals audible in the telephone are weakest when the poles of the rotating magnet have just passed the core and are increasing their distance from it, while they are strongest when the magnet poles are approaching the core.

Very good results have also been obtained by keeping the magnet fixed, and using an endless iron rope or core of thin wires revolving on pulleys (worked by a clockwork arrangement), which cause it to travel through the copper wire windings, in proximity to a horse-shoe magnet, or, preferaby, two horse-shoe magnets with their poles close to the windings, and with their poles of the same sign adjacent. In this case the copper wire windings are separated from the iron by means of a stiff, thin pipe of insulating material in order to prevent chafing of the wires. With this arrangement the signals appear to be quite uniform in strength.

There appears to be a certain magnetic force which gives best results, but different qualities of iron require different values. There would also appear to be a particular speed of revolution for the magnets employed which is more suitable than any other. Good results have been obtained when the magnets were caused to revolve at the rate of one revolution every 2 seconds, or, when using a moving core, by causing it to travel at a speed of about 30 cm. in 4 seconds.

Either iron or steel can be used for the cores or revolving rope, but by far the best effects are obtained when using hard-drawn iron wires or iron wire that has been considerably stretched or twisted beyond its limits of elasticity prior to its employment.

The cores used generally consisted of about thirty hard-drawn iron wires of approximately 0.5 mm. in diameter, with a winding on them made up of a single layer of silk-covered copper wire 0.019 cm. in diameter and of a total length of 2.4 metres. The other winding, connected to the telephone, has consisted of similar wire, and a sufficient number of turns have been employed to give a resistance about equal to that of the telephone used.

It would, no doubt, be possible to obtain the signals by causing the iron core to act directly on a telephone diaphragm, and in this case the secondary winding on the core could be omitted. The length of the electric waves used in the experiments between St. Catherine's Point and North Haven was about 200 metres. If longer waves are employed, it is desirable that the length of the winding nearest the iron should be increased.

This detector appears to be more sensitive and reliable than a coherer, nor does it require any of the adjustments or precautions which are necessary for the good working of the latter. Further advantages in its use become apparent when it is employed in connection with my syntonic system of space telegraphy. According to this system, electrical syntony between the transmitter and receiver is dependent on the proper electrical resonance of the various circuits of transformers used in the receivers. With certain coherers one difficulty has been that it was not always possible to restore them by mechanical tapping to the same electrical resistance which they possessed before being affected by the transmitted electric waves, the result being that the secondaries of the receiving transformers were at certain times open and at other times closed by a variable resistance, thus causing an appreciable variation in their natural period of electrical oscillation.

The magnetic detector described possesses, on the other hand, a practically uniform and constant resistance much lower than that of a coherer in its sensitive condition, and, as it will work with a much lower e. m. f., the secondaries of the tuning transformers can be made to possess much less inductance, their period of oscillation being regulated by a condenser in circuit with them, which condenser may be much larger (in consequence of the smaller inductance of the circuit) than those used for the same period of oscillation in a coherer circuit, with the result that the receiving circuits can be tuned much more accurately to a particular radiator of fairly persistent electric waves.

The considerations which led to the construction of the above-described detector are the following: It is a well-known fact that after any change has taken place in the magnetic force acting on a piece of iron, some time elapses before the corresponding change in the magnetic state of the iron is complete. If the applied magnetic force be either subjected to a gradual increase followed by an equally gradual diminution, or caused to effect a cyclic variation, the corresponding induced magnetic variation in the iron will lag behind the changes in the applied force. To this tendency to lag behind, Professor Ewing has given the name of magnetic hysteresis.

It has been shown also by Gerosa, Finzi, and others that the effect of alternating currents or high-frequency electrical oscillations acting upon iron is to reduce considerably the effects of magnetic hysteresis, causing the metal to respond much more readily to any influence which tends to alter its magnetic con-

dition. The effect of electrical oscillations probably is to bring about a momentary release of the molecules of iron from the constraint (or viscosity) in which they are ordinarily held, diminishing their retentiveness, and consequently decreasing the lag in the magnetic variation taking place in the iron.

It was therefore anticipated that the group of electrical waves emitted by each spark of a Hertzian radiator would, if caused to act upon a piece of iron which is being subjected at the same time to a slowly varying magnetic force, produce sudden variations in its magnetic hysteresis, which variations would produce others of a sudden or jerky nature in its magnetic condition. In other words, the magnetization of the iron, instead of slowly following the variations of the magnetic force applied, would at each spark of the transmitter suddenly diminish its magnetic lag caused by hysteresis.

These jerks in the magnetic condition of the iron would cause induced currents in a coil of wire of strength sufficient to allow the signals transmitted to be detected intelligibly on a telephone, or perhaps even read on a galvanometer. The tests referred to above confirm the belief that the magnetic detector can be substituted for the coherer for the purpose of long-distance space telegraphy.

Another paper presented before the Royal Society on the same date related to the effect of daylight upon the propagation of electromagnetic impulses over long distances. The greater part of the contents of the paper was resumed in the Royal Institution lecture, reprinted in our columns, and we give below the concluding portion, consisting of a discussion of the cause of the phenomenon observed:

The cause of these observed differences in the effects obtained by night as compared with those noticed by day may be due to the diselectrification of the transmitting elevated conductor, operated by the influence of daylight. The electrical oscillations in the transmitting elevated conductor may thus be prevented by the discharging influence of light from acquiring so great an amplitude as they attain during darkness. The diselectrification of negatively charged metallic bodies by light has been noticed by many observers, and as each alternate half-oscillation in the transmitting elevated conductor must necessarily charge it negatively, the dissipating effect of light on each alternate oscillation of the electrical wave in the transmitting wire may be sufficient to cause a material decrease in the amplitude of the oscillations.

Other tests were instituted with the object of ascertaining whether the illumination of the spark-gap of the transmitter had any effect upon the impulses transmitted, and accordingly the ball dischargers were inclosed in a box opaque to light. No perceptible difference, however, was noticed in the strength of the signals received, whether the spark-balls were or were not exposed to daylight.

It would be interesting to ascertain whether the same effects are to be observed when using transmitting elevated conductors covered with insulating material opaque to ordinary light. Mr. Marconi stated he had never noticed any appreciable difference in the distances over which signals are obtainable during the day and the night respectively in the course of all the other numerous experiments which he had carried out with installations not designed for very long distances, and in which the electrical power used at the sending stations has been small compared with that used at the Poldhu installation. Probably the much higher potential to which the elevated conductor at Poldhu was charged may have greatly increased the facility with which losses might occur due to diselectrification through the influence of daylight. In conclusion, Mr. Marconi said he hoped to be able to make a complete study of the effects described in this note, in the course of further long-distance tests which are likely to be undertaken shortly.

More Power from Chicago Drainage Canal.

It is currently reported in Chicago that a syndicate has obtained options on land lying along the Des Plaines River below Joliet for the purpose of utilizing the power made available by the flow of water from the Chicago drainage canal, which empties into that river a short distance above Joliet.

Electric Meters.

In the Patent Office issues of the last month, electric meters are represented by 12 patents. One of the most interesting of these is a meter patented to Thos. A. Edison. The principle of this meter consists in the employment (Fig. 1) of an electric motor, the speed of which is maintained constant by a centrifugal speed governor. By means of a worm this governor drives a horizontal shaft carrying a cam or cylinder, the longitudinal surface of which is curved to the arc of a circle. On this cylinder bears a friction wheel geared to the recording dial and carried by a frame attached to a scale beam below its fulcrum; one arm of this beam is weighted and the other is connected with the core of a solenoid. As the pull of the solenoid varies, the position of the arm changes, and with it the frame carried, and, therefore, the position of the above-mentioned friction wheel on the surface of the curved cylinder or cam driven by the constant-current motor.

The present patent relates to details of this device as follows: First, details of a centrifugal speed governor for the motor; second, improvements in the construction and arrangement of the indicator; third, in the use of cut-out devices for short-circuiting the indicator in the event of destructively large currents; fourth, in an improved manner of connecting the register with the constant speed motor,

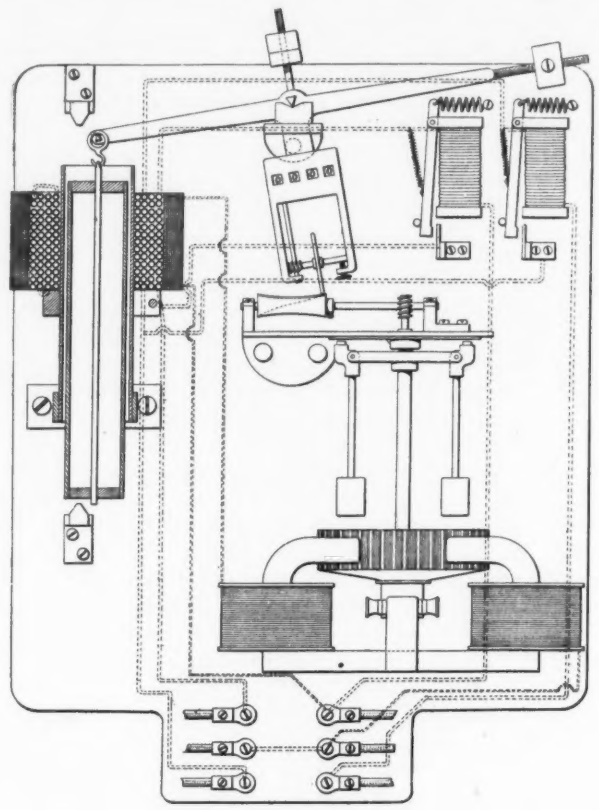


FIG I.—EDISON METER.

whereby during periodic intervals the current will be free to adjust itself to changes in the load, entirely independent of any friction other than the negligible friction of the knife edges of the scale and meter; fifth, the employment of means whereby may be overcome a slight error due to magnetic inertia in the registration of the first increments of current, and sixth, to means for the doing away of magnetic electric or elastic constants which are necessarily variable, and the employment of gravity only as a constant.

Another meter patent is on a means whereby only one pressure coil may be employed, the patentee being E. G. Holm, of Berlin, Germany. The means employed consists of a small piece of soft iron of suitable shape, attached to a part which revolves with the brake disk in such a manner that the attraction which the brake magnet or a separate magnet exercises upon it constantly tends to move the armature away from the dead points which it occupies at the short-circuiting periods of the pressure coil through the brushes of the commutator. During the revolution of the armature the soft iron piece alternately comes nearer to and recedes from the magnet, but the tractive power of the magnet is constantly exercised in the same direction—that is to say, it alternately accelerates and retards

rotation. Auxiliary brushes are provided for the purpose of short-circuiting the main brushes at the moment of the change-over or the reversal of the current.

Referring to Fig. 2, upon a spindle made readily revoluble both at the top and bottom, there is mounted the annular pressure-coil, *b*, the brake-disk *c*, the soft-iron piece (a double hook) *d*, the commu-

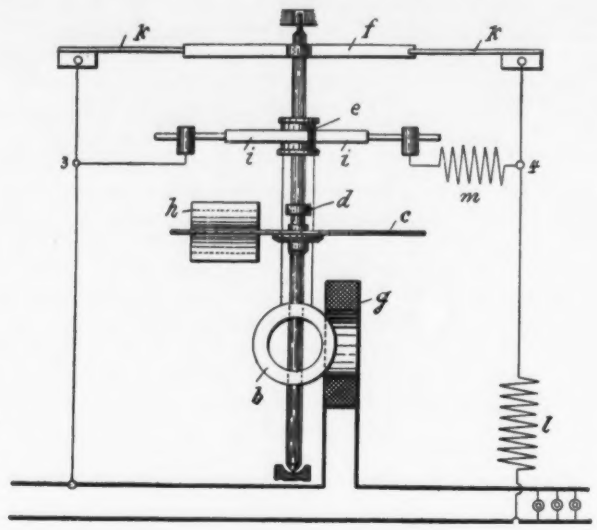


FIG. 2.—HOLM ELECTRIC METER.

tator *e*, and the insulated short-circuiting piece *f*. The stationary parts are the main-current coil *g*, the brake-magnet *h*, the commutator brushes *i*, and the auxiliary brushes *k*. In the main circuit there is only one coil, *g*, while in the pressure-circuit, in addition to the coil *b*, the two segments of the commutator *e*, and the brushes *i*, sweeping along these, there are located the preliminary switching resistance *l* and the small auxiliary resistance *m*, and in addition to that there are situated at the points 3 and 4 the auxiliary brushes *k*, which short-circuit the main brushes at the dead-point.

A patent issued to Prof. Elihu Thomson describes a new arrangement for obtaining the desired phase displacement of the shunt field in an alternating-current meter; a new arrangement for transmitting motion from the driving shaft to the recording mechanism, and a new arrangement of the terminal connections whereby the meter may be readily installed or removed. Referring to Figs. 3, 4 and 5, *D* is a disk armature mounted on a shaft, *X*. A portion of this armature is included between the poles of the permanent retarding magnet *M*. At a point removed from the latter and above the armature is located a series coil, S. On the other side of the armature and in a plane parallel thereto is located the shunt-magnet, *I*, and a series of coils, *K*, surrounding its core. The shunt magnet is so situated that the free poles of the laminated core lie directly below the center of the series coil on both sides. Interposed between the poles of the magnet core is a mass of conducting material, *C*, the function of which will be explained later.

The coils, *K*, constituting the shunt-winding, are connected in series with one another across the mains through which the current to be measured is upplied. The construction of the shunt magnet is such as to secure as high an inductance as possible in the shunt-circuit, so that the free shunt-field may be as nearly as possible in quadrature with the electromotive force impressed on the shunt-circuit.

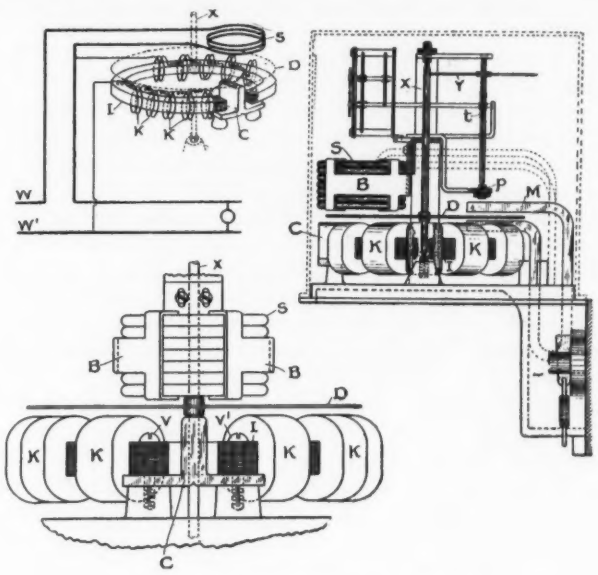
The free field across the gap between the poles of the laminated ring, *I*, would naturally tend to be greatest directly across the space between the poles, and would have a phase displacement somewhat less than 90 degrees behind the field, due to the series coil on non-inductive loads. In order to deflect this free field toward the armature, and at the same time to give this deflected field a certain increased phase displacement up to 90 degrees on non-inductive load, into this gap is inserted a body of copper or other suitable conducting material, *C*. This body of copper has a thick portion constituting a heavy inclosing circuit around the flux between the poles of the ring *I*. The flux being rapidly alternating in character cannot easily pass through the heavy conducting circuit which the copper piece presents, and, therefore, tends to be deflected, so as to pass around the same. This deflection is produced in virtue of the induced currents set up in the copper piece *C*. In order that the deflection may be toward the armature, the copper body is provided with a portion extending laterally beneath the poles of the shunt-magnet and is also made of considerable width, so that the shortest path around the copper mass is over the top of the portion projecting upwardly between the magnet poles.

The magnetic flux which actually passes over the part *C* and affects the armature *D* comprises two components, one of which consists of a portion of the main shunt-flux actually diverted around the mass *C*, and the other of which consists of a flux due to the induced currents set up in the copper mass itself by that portion of the main shunt-flux which threads the said mass. By properly proportioning the parts the resultant flux which affects the armature *D* may be made to lag by substantially 90 degrees behind the electromotive force of the circuit in which the meter is included.

In order that the flux may be caused to cut the armature *D*, it is desirable that the mass, *C*, be extended until it almost touches the armature, and, as already stated, in order that the flux may not be diverted in other directions it is desirable that the copper mass be extended to a considerable distance both below and at the sides of the shunt-magnet poles. The mass of copper tends, as it were, to shield the free field and to concentrate the effect on the armature, and at the same time it produces a field acting on the armature which is slightly later in phase than the magnetic flux induced in the core of the shunt magnet.

With the arrangement shown, the armature disk will not rotate unless current is flowing in the winding *S*, and its speed of rotation will be proportional to the energy to be measured.

In order to reduce as much as possible the friction of the moving parts of the meter, and at the same time to render it possible to make the parts small and compact, a magnetic gearing is interposed between the meter-shaft and the recording mechanism. This gearing comprises a thin disk, *Y*, of magnetic material, so positioned that it has a rolling engagement with the shaft *X*, which is constructed of some magnetic material, preferably of soft steel, and which may be slightly magnetized. The disk *Y* is mounted on a shaft of magnetic material, the lower end of which is pivoted in a gearing, *p*, in proximity to one of the poles of the retarding magnet, *M*. The supports for the different parts of the meter are constructed of brass or other non-magnetic material, and, therefore, the magnetism induced by the retarding magnet in the shaft upon which the disk *Y* is mounted



FIGS. 3, 4 AND 5.—THOMSON METER.

finds a nearly closed circuit of magnetic material through the disk *Y* and the shaft *X* back to the other pole of the permanent magnet. The amount of sticking between the edge of the disk *Y* and the shaft *X* may be nicely adjusted, so that the disk may be rotated as the shaft *X* revolves without any considerable frictional resistance. The upper pivot of the shaft upon which the disk *Y* is mounted is, of course, made free enough to permit the shaft and the disk to always remain in engagement.

In order to prevent actual magnetic contact between the shaft and the disk, a thin coating of non-magnetic material, such as brass or copper, may be applied either on the shaft or on the edge of the disk, or, if desired, both may be coated. The shaft upon which the disk *Y* is mounted is provided with a worm gear, *t*, which through suitable gearing actuates the recording mechanism in the usual manner. With

the arrangement just described, a very slight torque exerted on the armature *D* is sufficient to turn the disk *Y* through the shaft *X*, and the advantage of the leverage obtained by this construction materially reduces the retarding effect of the recording mechanism upon the meter shaft. If the worm gear, *t*, were placed directly on the shaft *X*, not only would the friction be considerably increased, but the parts could not be made so delicate or so small as is possible with the construction shown, and, as already stated, it is one of the objects of my invention to so construct the meter that it shall be small and compact. The patent also describes means for automatically connecting the meter to the line terminals.

An indicating meter—voltmeter or ammeter—is the subject of a patent granted to L. T. Robinson, the chief feature of which lies in the magnetic return strip employed instead of a spring to exert a restoring torque. In its general features the indicator is of the usual type, consisting of a moving system in a field between two magnet poles.

The moving element consists of a coil of fine wire wound on a spool or support, as shown in Fig. 6. The coil support *P* is mounted within a metal tube, *R*, of copper, which also tends to damp the oscillations of the needle. The ends of the tube are fitted with heads, m^2 m^2, each of which is extended to form one of the shafts or pivots *M' M'*. Mounted within the tube R and within the influence of the field magnets is a magnetizable return strip, *O*. As here shown, it consists of a very thin piece of magnetic material, *O*, occupying the space within the spool *P*, and is soldered or otherwise secured in the tube *R*. This strip may be formed by taking a piece of copper or similar material and plating it with magnetic metal—as iron or nickel, for example. Very good results have been obtained with a copper strip plated with nickel, but a very thin strip of soft iron gives good results. When assembled in the instrument, the magnetic returning piece, *O*, is substantially at right angles to the side faces of the magnet, so that the flux will pass from one face to the other through it.

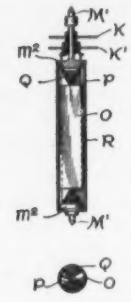


FIG. 6.—DETAIL OF ROBINSON METER.

The return strip is of exceedingly thin material working in a field strong enough to saturate it, or at least to carry its magnetism above the bend of the hysteresis curve in all positions. Such a strip will not exert any substantial effect on the flux passing between the pole pieces; and will not as it assumes different positions in the magnetic field substantially vary the strength or distribution of said field. Further, its own magnetism will remain very constant in all positions, at least unless it is deflected to an unreasonable extent, and the effect of hysteresis in the strip will therefore be very small. To make this result more certain, the instrument is so designed that the strip is considerably narrower than the distance between pole pieces, and also so designed with reference to the magnetomotive force in the air-gap that it is somewhere near saturation, so that its magnetism is not appreciably varied by changes in the flux, and ceases to depend on the value of x. Further, the effective position of its poles does not substantially change, so that the law of the instrument becomes simply:

$$x = tan.^{-1} D I.$$

It is, of course, easy to change this to the more general law: $x = f(I)$, the function being a simple linear one by merely adjusting the angle between the coil and the strip. This has the effect of varying the scale, which is "crowded" at the top if the law is:

$$x = tan.^{-1} D I.$$

and may be crowded at the center or at the lower end, or at both ends, or made substantially even by a proper adjustment of the angle above-mentioned, and by properly shaping the coil and pole pieces.

Mr. Arthur Wright, of Brighton, England, well known for his work in connection with central station systems of charging, is represented by six patents. Two of these relate to maximum demand indicators on the well-known Wright principle, three to electrolytic-current meters, and two to details of meter circuits. Figs 7 and 8 show forms of meters described in the first-mentioned patents, being improvements in the original type of maximum meter patented in this country by Mr. Wright, in 1897. Referring to Fig. 8, the main improvement consists in the use of a trap bulb, 4, below the expansion bulb of the maximum demand meter, and in a new form of index tube. The ordinary compression bulb is numbered 5, but the expansion bulb, 1, instead of being continuous with the limb 2 of the U-tube, is drawn out at one part to a nozzle, 3, which nozzle is sealed into a trap bulb, 4, so as to penetrate for some distance into the same. The object of this arrangement is not only to prevent the liquid from entering the expansion bulb on the instrument being re-set, but also to prevent air passing from the compression bulb around to the expansion bulb should any sudden cooling of the expansion bulb take place during re-setting. Two or more such expansion bulbs may be used, and the patent gives details of the construction of the multiple forms.

Another improvement included is that the index tube, 9, is made conical in form, the advantage being that it will thus hold a larger amount of liquid than the cylindrical form of index tube, and allow the instrument to have a larger range of registration, say from one-twentieth to its full load capacity. It also allows of a larger scale reading to be obtained with a smaller current, and, owing to the swelling out toward the top of the cone, enables the reading to be crowded together at that point so as to form a longer range of current readings than if the divisions were equally placed over the scale. The general operation of this meter is the same as of the earlier form. The effect of the heating resistance about the expansion bulb is to cause the liquid in the meter to spill over into the index tube, the amount of the liquid in such tube being read off on the scale. This

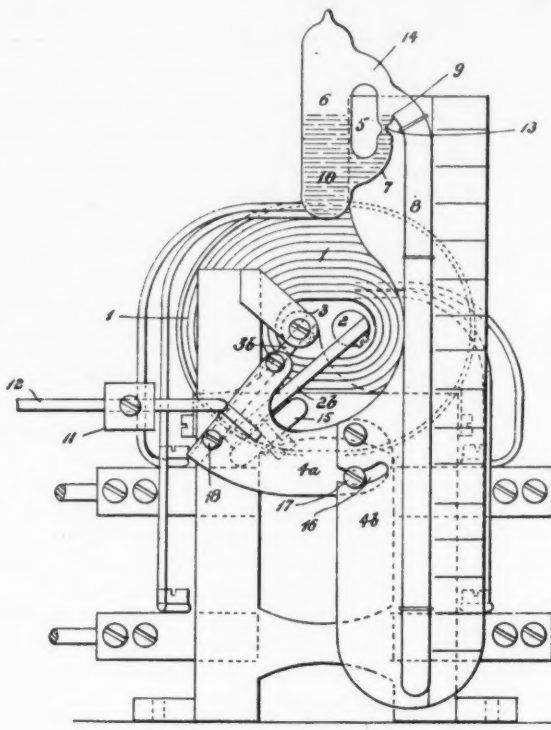


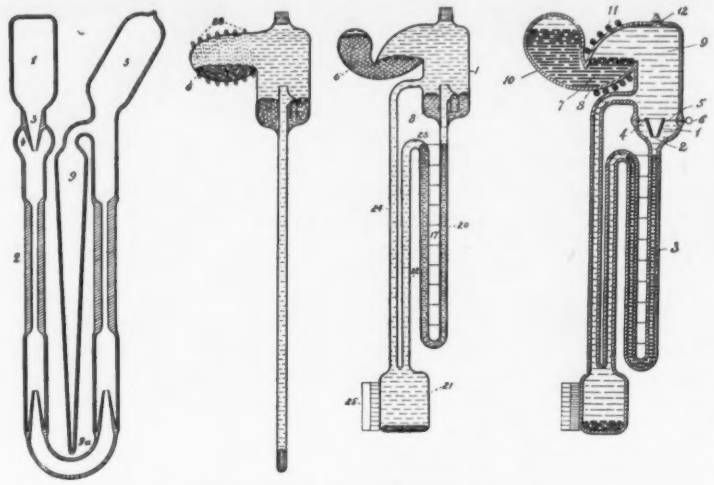
FIG. 7.—WRIGHT MAXIMUM DEMAND METER.

scale may be so calibrated as to enable the user to read therefrom the maximum amount of current which has passed since the instrument has been set. To re-set the meter it is merely tilted at such an angle as to cause the liquid in the index tubes to flow back into the compression bulb.

A second patent relates to a demand meter of a type quite different from the original Wright instrument. In this new type, instead of the liquid being driven into the index tube by means of expansion caused by current flowing through a heating coil, the tube is tilted and spills into the index tube an amount of liquid depending upon the angle of tilt, and which in turn depends upon the value of the current passing. The tilting arrangement is actuated by a coil having two armatures, one of which is fixed and the other is movable. These armature cores lie side by side within the coil, and being similarly magnetized by the current in the coil, they repel one another; but as one is fixed the second alone will move, and the amount of this movement will vary with the current traversing the coil. This form of indicator is shown in Fig. 7. The tilting arrangement is pivoted at 3, and the action of the current in the coil is to tilt the top of the tube to the right, whereupon the registering liquid flows into the indicating tube, *H*. In order to prevent a spill from a sudden kick produced by a momentary current, there is a constriction at

13. In resetting the meter the liquid returns to the receiver through the passage 14.

As stated above, three of the Wright patents relate to a new form of electrolytic meter. Referring to Figs. 8 and 9, the former shows a simple form of such a meter, and the latter shows the same with a cathode feeder and a "second dial effect." The liquid 1 (Fig. 10) is an electrolyte, which may be a solution of mercurous nitrate. A pocket in the same chamber contains a



FIGS. 8, 9, 10 AND 11.—WRIGHT METERS.

mass of mercury constituting the anode, in connection with which is a feeding chamber, 6. Around the anode portion of the chamber may be a coil, 28, to set up convection in the electrolyte, in order to prevent crystallization, which is further prevented by keeping the anode level constant by means of the anode feeder. A pocket of mercury at 8 constitutes the cathode. Referring now to the simpler form shown, the action is as follows:

The instrument being arranged usually in shunt, when the current passes, the volume of mercury constituting the anode decreases, while the volume of mercury constituting the cathode increases, the increase of the cathode being a measure of the electricity passed. As the volume of the cathode increases mercury will pass from the cathode-chamber and flow over into the tube shown, at the bottom of which it will collect. This tube is graduated or has a scale attached to or placed beside it; the volume of mercury in the tube can then be read off by noting the level of its surface, the said level showing the amount of current which has passed since the instrument was reset. Such resetting may be obtained by turning the instrument through half a revolution until it is upside down, and then onward through the other half revolution until it again reaches its normal position.

The function of the arrangement shown in the cathode chamber is as follows: As is well known, the surface tension of a mass of mercury is so great that as soon as a small quantity can pour over a lip, a considerable mass is brought over after it. In other words, it flows over not in minute quantities, but in considerable "blobs," as it is termed. By partitioning off a small part of the mercury, as shown, instead of the mercury coming over in large blobs, it may be made to come over in very minute quantities, so as in fact to give delicate readings. The intermediate chamber may be of any desired form and may consist of a mere partitioning off of a part of the mercury or of its chamber. A mere strip of glass, for example, placed close to the overflow-lip may suffice for the purpose of partitioning off, so as to obtain an intermediate chamber.

In Fig. 10 is illustrated a means for obtaining the second dial effect of a geared registering mechanism. In this figure, 1 is the main chamber of the meter, containing the electrolyte, 6 is the anode, and 8 the cathode. Increase of the mass of the cathode on passage of the current causes mercury to be transferred to the U-shaped tube 20, where its height in the two limbs can be read off by the scale 17. 21 is a receptacle connected by a tube 22 with the upper part 23 of the second limb of the U-tube 20. 24 is another tube connecting at a point above the cathode the main chamber 1 with the receptacle 21. The action is as follows: When sufficient mercury has passed into the U-tube to rise through the bend at the point 23, a flushing action of a well-known kind will take place, and the whole of the mercury in the tube 20 will flow into the receptacle 21, and each time that the U-tube is filled with mercury it will empty itself into the receptacle 21. If a scale, such as 25, be attached to or placed beside receptacle 21, each division of which is equal to the whole space of the U-tube, it will be seen that a reading of a true second-dial effect is obtained.

Another patent describes mechanical arrangements by means of which the meter may register along a scale or by a train of gearing. This may be accomplished by the decrease of weight of the mercury anode or increase of weight of the mercury cathode. In one case shown, the mercury constituting the anode is supported in a receptacle; as the weight decreases, a spiral spring in connection with a rod extending from the receptacle causes the extension to move a lever along a dial. In other cases the change in weight causes the meter as a whole to tilt, thereby actuating a dial hand or a train of gears.

In another form of meter a platinum cathode is employed, as shown in Fig. 11. This cathode consists of a cone, 1, of platinum foil, with its apex pointing downward, the said apex being cut off so as to form an orifice, 2, through which the mercury deposited in the interior of the cone can drop freely downward into the depositing-tube 3. Any mercury deposited on the outside of the said cone will also drop freely into the depositing-tube. The cathode 1 is supported by the platinum wires 4, 5, the wire 5 being sealed into the glass and 4 being sealed through the glass and continuous with the connecting-wire 6. The mercury, 7, constituting the anode, is contained in the anode-chamber 8, this anode-chamber being shown in the form illustrated as a pocket arranged on one side of the instrument.

Of the two remaining Wright patents, one relates to a circuit arrangement whereby the counter e. m. f. of the meter is counteracted, and another to a circuit whereby both an electrolytic and maximum demand meter may be employed with no further loss than entailed by a single instrument.

Commercial Pacific Cable Plans.

It is stated that the Commercial-Pacific Cable Company has laid before the administration at Washington a proposal that if the soundings in the Pacific Ocean, taken by the United States boat "Nero," are thrown open to that company for use in laying its cable, the company will agree to have the entire cable from San Francisco to Manila laid and in operation by June 1, 1903, which is less than eleven months from now. This is over one and a half years sooner than the company has at any time before indicated that it could put the cable into operation. The Western Union Company has all along favored the Corliss bill for laying of this cable by the United States Government, by which bill the Western Union would get a part of the land-line business on messages between the United States and Asia. That bill was defeated, and the Asiatic business will go to the Commercial Cable Company and the Postal Telegraph Cable Company. The Administration is considered most likely to throw open the soundings to the public, including the Commercial Cable Company, just as it has always thrown open to the public all soundings taken by the government along the coasts of the United States and elsewhere. It appears that the United States Government has already published the general soundings between San Francisco and Manila, but has in its archives details which are essential to the laying of the cable, and these are the details which the Commercial Cable Company wishes to use.

It is announced that the rates which will be charged the United States Government by the new Pacific cable will be 50 cents per word, which is over $1 less than the present rate paid by the government. This in itself is a great inducement to the government to expedite the enterprise.

British Pacific Cable.

The cable steamer "Colonia" sailed from London on July 10 for Vancouver to lay the British Pacific cable from British Columbia to Fanning Island. Another steamer will sail in a few days to lay the section from Fanning Island to the Fiji Islands. The Colonia was recently illustrated and described in these pages.

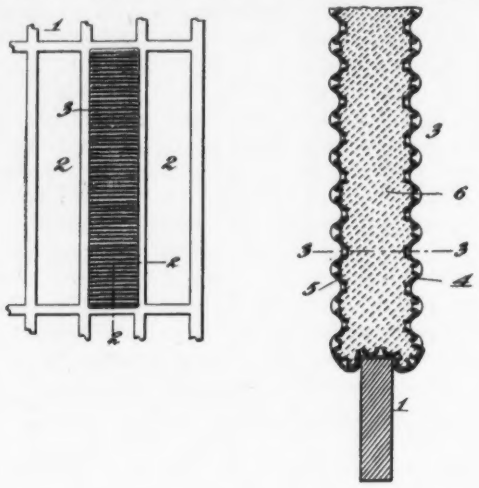
Recent Electrochemical Developments.

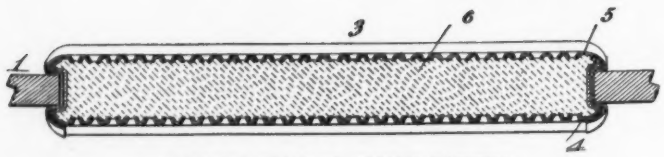
CLINTON PAUL TOWNSEND.

ADDITIONAL EDISON PATENTS.

In discussing the theory of Edison's reversible batteries, and in forming such estimates as we may of their commercial promise, one is apt almost to overlook the inventor's undoubtedly valuable contribution to the chemistry of the metallic oxides; their constitution, the conditions of their formation and reduction, and, above all, their relations in alkaline solutions. The question of their solubility has been largely one of minute measurements, for local action does not cease at the second or third decimal.

A series of four patents in the current Patent Office issue, deals with both the chemical and mechanical aspects of the cell. The first patent covers the reversible series, namely, zinc-alkali zincate-oxide of mercury. In this series the zinc is plated upon magnesium in the manner heretofore described, and the fact that upon charging the mercuric oxide passes to some extent into solution is advantageous rather than otherwise, since the resultant amalgamation of the zinc aids in depositing it in coherent form; it is the one exception to the rule of deleterious local action from traces of the depolarizer in the





MODIFIED FORM OF EDISON BATTERY.

solution. For retaining the mercury perforated pockets are employed as for the solid depolarizers.

The second patent relates to the iron-cobalt oxide cell, and insofar as disclosure is concerned, is identical with the companion case on nickel oxide. A third, containing specific claims to the employment of copper in a state of extreme subdivision as an insoluble oxidizable electrode, has already been described in these columns, the invention having been disclosed in an earlier case. It is in this connection that Mr. Edison makes the extraordinary statement that the tendency of copper to dissolve in the electrolyte may be overcome by a sufficiently fine division.

The fourth patent covers the modified form of the cell shown in the accompanying figures. The usual grid, 1, is provided with rectangular openings, 2, into which the perforated receptacles, 3, for the active material are secured, the sides, 4 and 5, being fitted one into the other and securely locked by crimping the edges around the grid. The special feature of the present patent is the horizontal corrugation of the perforated walls of these pockets, the effect being to so stiffen them as to permit the use of very thin high carbon steel for the walls; by this means the elastic limit of the walls is increased and a more effective contact maintained with the active material through the changes of bulk consequent upon charging and discharging.

METHOD OF FRAMING GLASS.

Two patents to Julius Taluau, of Philadelphia, and a third issued jointly to Taluau and Henry W. Scattergood, also of Philadelphia, deal with the tempting proposition that fragments of glass, stone or other non-conductor, may be united into a mosaic or similar structure by means of an electro-deposited framework of copper filling the interstices between the pieces. Such mosaics are of pleasing appearance, and the nodular surface of the deposited metal, if not too pronounced, rather heightens the effect.

In 1889, Henry F. Belcher patented a process consisting in electroplating the exposed surfaces of the cast-metal framework of a stained glass window in such manner as to securely bind the fragments by the overlapping deposit. In 1897, William H. Winslow, of Chicago, patented a method for assembling rectangular blocks of glass, the essential feature being the provision of a framework of copper strips extending around and between the blocks in rather loose relation to them, and serving as a foundation for a subsequent electro deposit of copper to firmly secure the several parts. The Luxfer Prism Patents Company, of Chicago, operating under this method, has for several years past been placing extremely rigid and ornamental prism lights upon the market.

According to Taluau's method electrodeposition is relied upon to build up the interstitial deposit; the fragments of glass are cemented in their proper relation upon a backing plate of lead foil and properly supported in the plating bath. The deposit is built up from the backing plate to, or even above, the upper surfaces of the glass, lapping slightly for additional security. For transparent constructions the backing plate is finally stripped off. As modifications of the method a non-conducting support may be used, a conductor, as plumbago, being applied to the interstices, or the process may be somewhat hastened by using metal filings between the plates.

It is not clear that the new method is an improvement over that of Winslow, for every electroplater is familiar with the difficulties which arise when it is sought to increase the thickness of an electrodeposit above a certain rather small maximum. The deposit tends to become loose, nodular, and even branching, and it is with the greatest difficulty and only by working slowly and with low current densities, that the character of the early deposit can be maintained. It seems also that these difficulties, sufficiently pronounced upon a plane surface, are increased when the effort is made to deposit metal between adjacent non-conducting walls constituting a virtual crevice, for it is not easy to maintain the concentration of the metal ions under these conditions. It may be safely predicted that the element of time will enter into the new method as a serious factor.

New Telephone Patents.

Two patents relating to telephony occur in the issue of July 8, one protecting a combined district telegraph and telephone signal, the other a protector. Mr. Charles Selden, of Baltimore, adapts the familiar make and break messenger call to send a distinctive signal to

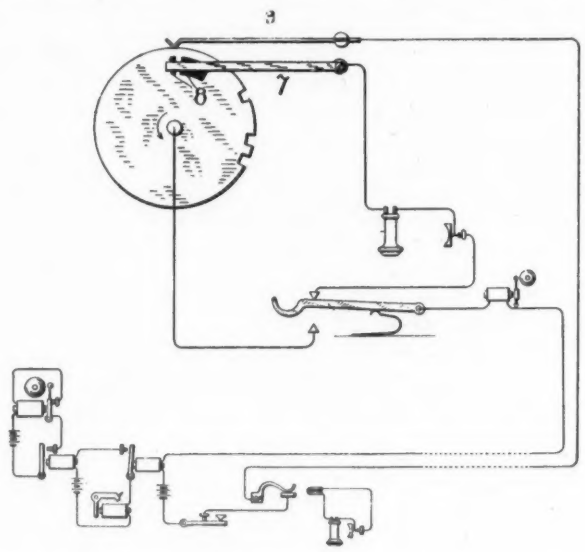
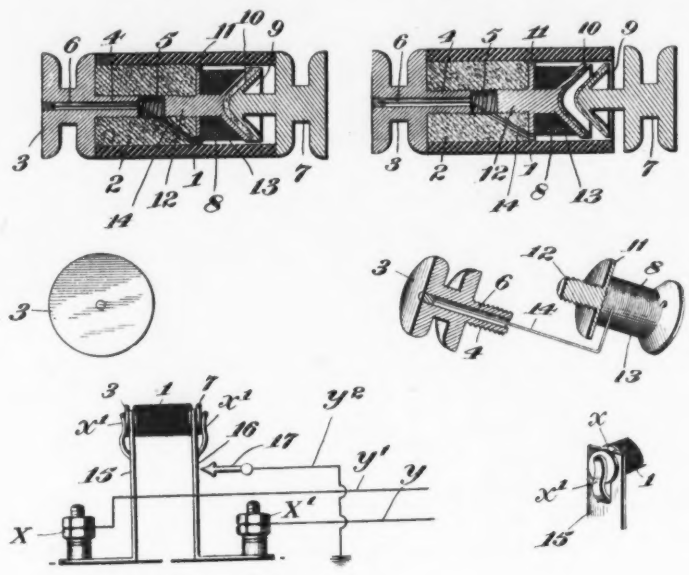


FIG. 1.—SELDEN'S COMBINED TELEGRAPH AND TELEPHONE SIGNAL.

serve as a call for telephone connection, by supplying the contact-wheel with an extra brush bearing on its surface instead of on the periphery and operating a vibrating bell at the central, instead of a single-stroke bell. In the drawing 3 is the brush giving the normal

messenger call signal when the box is operated, and 7 is the special brush for the telephone signal; opposite the bearing point of 7 on the surface of the contact wheel are insulating strips or spaces, 8. By lifting the receiver from the hook switch, 6, the brush, 7, is switched into circuit, and on the box being pulled the signal governed by 7 is transmitted. This signal is usually a long dash operating a vibrating bell and so readily distinguishable from the messenger call signal which is a combination of dots.

Mr. Frank B. Cook, of Chicago, patents a protector, for which he claims simplicity and cheapness of construction, and the advantage that in operation the heat coil is not damaged, the only change produced in the appliance being the melting of the solder. Referring to Figs. 2 to 6, Figs. 1 and 2 show the appliance in detail, Fig. 2 representing the solder, 10, as melted, and the circuit opened. Fig. 3 is an end view, Fig. 4 a perspective of the heat coil and cap, Fig. 5 a diagrammatic view of the protector mounted for use, and Fig. 6 an end view of the protector and supporting spring. A cylinder of insulating material, 1, contains the heat coil, 8, which has a flange, 11, and



COOK'S THERMAL PROTECTOR.

stem, 12, screwing into the insulating sleeve, 2, set in cylinder 1. Into 2 also screws the cap, 3, which has a groove or collar to fit the forked end of the supporting spring. The wire of the heat coil is connected to the cap, 3, through the bore, 6, in the shank, 4. The outer end of the heat coil has a concave depression into which fits the convex end, 9, of the cap, 7, the two being held together by the solder, 10. One end of the heat-coil winding is soldered to the metal concave head, 8, so the circuit from cap, 7, to cap, 3, traverses the heat coil and the solder, 10, which holds 7 and 8 together. The complete protector is mounted as shown in Fig. 5, on two springs, 15, 16, which normally bear outward and are held in tension by the protector. When the heat coil operates, solder, 10, is melted and cap, 7, is pulled away by the tension of spring, 16, which then comes in contact with ground stop, 17, and grounds the line.

Moving Sidewalk for Brooklyn Bridge.

The plan of an electric moving sidewalk for Brooklyn Bridge has been revived, a company standing ready to undertake the installation. The plans as drawn by Mr. George S. Morrison, the company's consulting engineer, provide for a main platform, 8½ feet wide, to run on the tracks now used for the bridge cars. This was to be provided with cross-seats, and would be, in effect, one continuous street car. Being built in 12-ft. sections, with the rounded end of one fitting into the concave end of the next, it could go around curves of small radius. The cars would not be roofed, but a light covering like a gallery would be erected over the whole track, which would serve the same purpose.

The station platform at the Manhattan terminus would not be materially altered in size. Around its outer edge, the plan provides for three narrower moving belts, three feet wide. The first would move at 2½ miles per hour, the second, two inches higher and overlapping a trifle, at 5 miles an hour, and the third at 7½ miles. The third in turn would overlap the main platform, the rate of which would be 10 miles an hour. Passengers could walk across diagonally to their seats without any uncomfortable jar. For getting off and on, 361½ feet are allowed in the plan. To prevent possible accidents to persons trying to crowd on at the extreme end of the platform, a railing would be hung from above to guard the moving platforms. A high grating would separate the arriving and departing platforms, each of which would be 23½ feet wide. The plan is warmly favored by Commissioner Lindenthal.

Vermont Electrical Association.

A meeting of a number of the representatives of the electric lighting interests in the State of Vermont was held in Bellows Falls, Vt., July 9, 1902. The question of forming an association similar in scope to the National and other State electrical associations was thoroughly discussed, and it was decided that it was expedient to do so. The result was the formation of the Vermont Electrical Association, with the following list of officers and executive committee: President, Harry Bottomley, Bellows Falls; 1st vice-president, C. F. Thompson, Brattleboro; 2nd vice-president, M. Patterson, Fair Haven; secretary-treasurer, C. C. Wells, Middlebury; executive committee, E. E. Larrabee, Bennington; E. D. Blackwell, Brandon; E. E. Gage, St. Johnsbury; G. S. Haley, Rutland; F. Barney, Jr., Springfield.

CURRENT NEWS AND NOTES.

WIRELESS TELEGRAPHY AND SUBMARINES.—A cable dispatch from Paris, of July 10, says: There was a successful test at Cherbourg to-day of the application of wireless telegraphy to submarine torpedo boats. A mast with receivers was fitted to the submarine boat, "Triton." The vessel dived and received signals from the central submarine station clearly.

THE ARC LAMP IN EXAMINATION OF GEMS.—As a result of some observations by Mascart on the effect on gems of the violet rays from an arc lamp, M. Chaumet has recently made some experiments with a view to the use of such rays in the determination of the value of gems. Becquerelainé noted years ago the fluorescence of diamonds under the influence of various colored rays. Chaumet has ascertained that there is a close relationship between this fluorescent property and the brilliancy of diamonds under artificial light, particularly candle-light, which brings out most clearly the quality of first-class stones. Diamonds that sparkle most vividly are not always those cut in the most regular shape, but those showing the greatest amount of fluorescence when examined with violet light. While diamonds that are non-fluorescent when exposed to this light simply take a violet coloration, the most sparkling stones show a notable fluorescence of a very luminous and clear blue. Diamonds, whatever their quality, always offer the same transparency to Röntgen rays, so that it is impossible to differentiate them by means of radiography. In a jewel-case in which are grouped diamonds of all qualities, the gems, when illuminated by violet light, assume different tints, some showing a vivid blue brilliance, while others are of a sombre violet. As soon as the electric lamp is put out, all degrees of phosphorescence are noticeable, the jewel-case appearing to be studded with violet or blue glowworms, some very bright, others almost extinct; and the most sparkling stone will be found to be the best. In the course of his experiments, M. Chaumet has observed a curious fact with respect to a yellow diamond with numerous facets which showed remarkable golden reflections in daylight as well as in artificial light. The violet light produced no fluorescence in this case, but gave rise in place to flashes of an intensely red color, particularly noticeable on the feather-edged sides. A violet pencil of rays was projected upon this yellow diamond for a few minutes, when the experimenter found to his surprise that the yellow color had changed to dark brown, the stone thus losing four-fifths of its commercial value, which, however, was recovered after some hours. In experimenting on the action of the various rays on rubies, M. Chaumet has ascertained that the Siamese stones are of scarcely appreciable fluorescence under violet light, while all the valuable Burmese rubies are intensely fluorescent, exhibiting a clear vivid red light that puts them in evidence when they are mixed with stones from Siam, which remain sombre.

RUHMER'S WIRELESS TELEPHONY.—A cable dispatch from Berlin, of July 12, says: "Ernst Ruhmer, the physicist, has invented a system of wireless telephony. His experiments have been successful over a distance of three miles. The invention acts on the principle of the transformation of light waves to sound waves by using a searchlight and a microphone." There does not seem very much new about this to an American who has followed the work of Bell, Hayes and others.

ELECTRICITY AND THE KING.—It is stated that during his recent illness, King Edward has derived much benefit and relief during the hot weather from the use of fan motors in his bedroom. He is now to be moved to the royal yacht, and a new dynamo is to be put in to minimize the vibration of the plant. St. James' Palace, one of the royal residences in London, has been newly equipped with thousands of electric lights and these were used with great effect at the reception given by the Prince and Princess of Wales to the coronation Colonial visitors in London last week.

NEW RADIO-ACTIVE ELEMENT.—A special cable dispatch from Berlin, of July 9, makes the following announcement: Professor Marckwald, of the Berlin University, announced at the last meeting of the Physical Society that he had discovered a new element. The element in question is radio-active and of extraordinary energy. Professor Marckwald has separated it from radio-active bismuth, so-called polonium, found in uranium ore. It consists, as Professor Marckwald discovered, substantially of ordinary bismuth and of a new metal in the proportion of a thousand to one. The new metal can be separated by the electrolytic process. The rays it emits are something like those of the metal radium, but differ in being almost completely absorbed by paper as well as by glass. Professor Marckwald has proved that a porcelain tube heavily charged with electricity by rubbing immediately lowers its charge when a morsel of this metal weighing hardly a milligramme is brought within a distance of one decimetre. A chemical analysis of the new metal is rendered very difficult by the fact that one ton of ore contains hardly one gramme of it.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—The National Electric Light Association has just issued a new edition of "Municipal Lighting Statistics" for the confidential use of its members. It is full of information from all over the country as to rates for arc lighting, etc. The association has enrolled the following new members since June 28: Albert Lea, Minn., Albert Lea Light and Power Company; Anaconda, Mont., Anaconda Copper Mining Company, Elec. Dept.; Clay Center, Kan., F. L. Williamson & Co.; Durango, Colo., C. H. Peters; Fair Haven, Vt., Fair Haven Electric Company; Lancaster, Ohio, The Lancaster Electric Light Company; Mason City, Ia., Brice Gas and Electric Company; Menomonie, Wis., Menomonie Electric Light and Power Company; Middlebury, Vt., Middlebury Electric Company; Montpelier, Vt., Consolidated Electric Company; New Albany, Ind., United Gas and Electric Company; Nokomis, Ill., Nokomis Electric Light and Power Company; Nyack, N. Y., Rockland Light and Power Company; Norwich, N. Y., Norwich Gas and Electric Company; Red Wing, Minn., Red Wing Gas and Electric Compony; Rutland, Vt., Rutland City Electric Company; Tuxedo, N. Y., Tuxedo Electric light Company; Wabash, Ind., The Wabash Electric Light Company; Watertown, N. Y., The Watertown Electric Light Company.

ELECTRIC FURNACE IN MANUFACTURE OF STEEL.—A recent consular report gives an account of the manufacture at Gysinge, Sweden, of steel in the electric furnace. In the latter part of February, 1900, the first furnace was finished and ready for trial, and after a few experiments the first ingot was produced. The steel was found to be of excellent quality, but with the dynamo of 78-kw used, not more than 575 pounds of steel were obtained in twenty-four hours, and the furnace had a capacity for only 176 pounds. A larger furnace was seen to be necessary, and this was completed in November, 1900, and proved to be a great improvement. In the second furnace, which held 397 pounds, from 122 to 134 pounds of steel were produced in twenty-four hours. The Gysinge sulphite factory burned down on August 11, 1901, and it was decided to build steel works in its place and to use the water power available there. For the steel furnace there was utilized a turbine of 300 horsepower, with direct-coupled generator. The new furnace is to have a capacity of 3,970 pounds and the production is estimated to be at least 1,500 tons a year. The steel produced is said to be of superior quality, and characterized by strength, density, uniformity, toughness, and the ease with which it can be worked in cold, unhardened condition, even when containing a very high percentage of carbon. Compared with other steel, it also has less tendency to crack or warp when hardened. The reason why this steel in certain qualities differs from other steel, especially in its softness when unhardened, is considered to be its freedom from gases. The manufacture of special steel, with nickel, chrome, manganese or wolfram, will, of course, not meet with many difficulties. The chrome steel and wolfram steel produced at Gysinge has proved to be excellent for lathe tools. When used for permanent magnets, the Gysinge wolfram steel has been found to give stronger magnets than other wolfram steel and has not warped in the hardening. From estimates made, it has been ascertained that the furnace used at Gysinge, which is simple in construction and easily managed, has prospects of competing, as to cost of operation, with the furnaces heretofore used for fusion of steel, especially as it yields steel of a better quality.

LETTERS TO THE EDITORS.

American Association for the Advancement of Science.

To the Editors of Electrical World and Engineer:

Sirs.—I think I echo the thought of many of your readers in expressing appreciation of the very full report which appears in your issue of July 5, of the recent meeting of the American Association for the Advancement of Science. If in previous years there was similar material which might have been available for presentation to the readers of technical journals, it is a real misfortune that the administration of the Association has seen fit to ignore this channel for the dissemination of knowledge. It is indeed no less than astonishing that the association has not in the past taken advantage of the opportunity for the advancement of science afforded by the technical press of this country. According to newspaper reports, of a total of almost 350 papers, more than 150 were presented in the departments of physics, chemistry, mechanical science and engineering. As these several sections held their sessions simultaneously, and most of the papers were probably read merely by title or in brief abstract, the impossibility of any one in attendance at the meeting deriving full benefit from their attendance is evident. It is true that members of the association receive in an annual volume an account of the proceedings at the meeting of the year, but aside from the relatively small audience to which this belated volume goes, many of the papers appear therein only by title, and for many others— perhaps the majority—readers are referred to periodical publications of such a character as to be unavailable to all but a select few. For example, in a volume of the A. A. A. S. *Proceedings* before the writer, the reader is constantly referred to such journals as the *Philosophical Magazine, American Chemical Journal, Journal of Physical Chemistry, The Physical Review,* etc., for papers mentioned only by title in the volume, or appearing in bare abstract. If the governing body of the Association were to provide facilities enabling the technical journals of the country to use such portions of the proceedings as appealed particularly to their respective readers, that body would, I believe, rapidly assume a position in this country similar to that occupied in Great Britain by the British Association, and would also greatly extend its membership among the technical classes. A glance over the list of membership shows that in the past these classes have held aloof—for a very good reason it would appear.

BOSTON, MASS. CHAS. L. MANSON.

State and National Telephone Associations.

To the Editors of Electrical World and Engineer:

Sirs.—I am glad to note the attitude taken toward the abuse heaped on Bell telephone men in your recent discussions of the work of the National convention, at Philadelphia. Such attacks on personnel as you have stigmatized have nothing to do with the merits of the case, and there is no question that the men aimed at have long enjoyed the esteem of the electrical public. It would be just as fair to assert

that every man who has gone into the independent telephone field is a "striker," who proposes at some time or other to make a deal with the Bell companies regardless of the public.

It is not quite clear to me, however, that your advocacy of the National Association does full justice to the various State organizations. What you say about the poor policy of dividing forces in face of a strong enemy is true, and there certainly should be and must be the best kind of a national body, so that it is unwise on the surface to detract from the interest and importance of that annual affair. But the point you seem to overlook is that these minor State and interstate organizations are created mainly by the need of fostering toll lines and developing long-distance work. Presently, large companies will grow up out of the scattered units, and probably we shall see only a few independent companies in each State. As an old telegrapher, I remember the history of the telegraph art in the bringing together of scattered systems, and I cannot see how the telephone business is different. For the time, then, it is plain to me that the State associations are doing excellent work in getting people acquainted and in laying the foundation of large local networks. The Western Union telegraph system began in this humble fashion, although in its early days there were no conventions to help things along. Moreover, it is particularly in the big western States that the newcomers in telephony need to co-operate.

This view granted, I believe with you that the best efforts of the independents should be devoted to strengthening their National Association, giving it the right and power to speak with authority for the art as a whole.

ST. LOUIS, MO. PAUL M. RICE.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Nonsynchronous Single and Polyphase Generators.—HEYLAND.—A long illustrated paper read recently before the Society of German Electrical Engineers. He claims the following advantages of his type of generator over the old normal synchronous alternators: First, the problem of parallel operation of alternators is solved in an easy way; secondly, the new machines have an ideal elasticity against variations of load and besides this they can be exactly and absolutely compounded against voltage variations by a simple accessory. In the first part of the paper he discusses the simple "compensation," *i.e.*, the arrangement by which the power factor is made equal to unity; this has already been described repeatedly and at length in the Digest; the description which Heyland gives in the present paper is somewhat more exhaustive and illustrated by vector diagrams, he also gives diagrams showing how the compensating winding can be best arranged. The commutator is no longer a principal part of the machine; it is only an accessory for the purpose of self-excitation; it is so small and operates sparklessly like an ordinary slip-ring; it has only just enough segments that an electric short-circuit between two succeeding brushes is avoided, 4 to 6 segments being used per pole. He shows theoretically that on account of the compensating winding, the efficiency does not become lower, but may even be increased. For perfect compensation the self-excitation produces an increase of the overload capacity by 40 to 50 per cent. There is no armature reaction. The exciting current is nearly constant for all reactions. The curves given in the adjoining Diagram 1 represent the results of tests of a 12-hp motor,

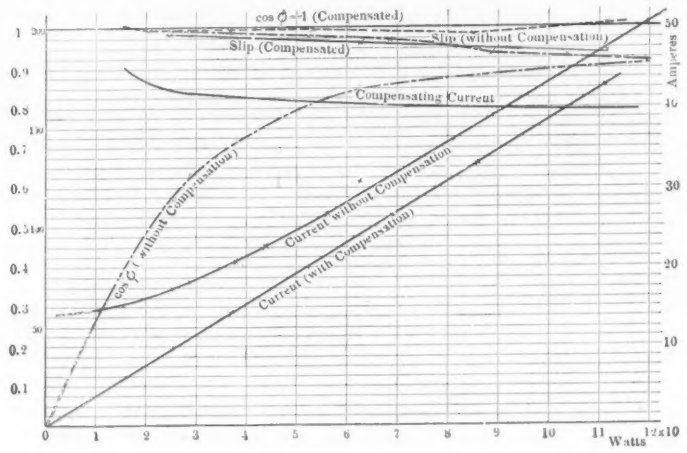
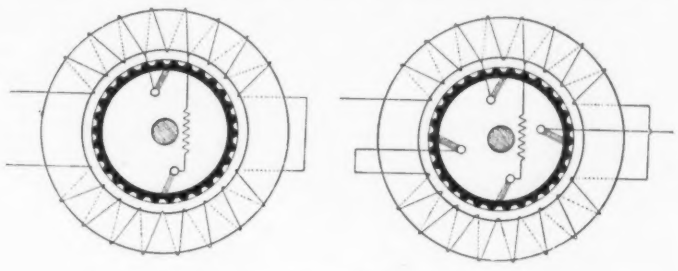


FIG. 1.—RESULTS OF TESTS OF 12-HP MOTOR.

built by the United Electric Company, of Vienna. The power factor is here always exactly equal to unity, even for no-load and for overload. In the second part of the paper the author discusses the method of compounding. For non-inductive load there is a natural compensation, due to the currents induced in the rotor. These induced currents, however, are always in phase with the energy component of the main current, and, therefore, for wattless currents the full armature reaction remains. For complete compounding he uses the following device; besides the compensating current, he also sends the main current into the rotor through a second set of brushes, so that it must overcome the stator amperewindings in any case. Figs. 2 and 3 show the arrangement for a



FIGS. 2 AND 3.—NON-SYNCHRONOUS GENERATORS.

single-phase machine, Fig. 2 representing a compensated machine without compounding, Fig. 3 with compounding. Instead of supplying the stator current to the rotor, it is sufficient to supply the wattless component only; with machines operating in parallel, this can be accomplished by compounding the one, but not the other, and sending the main currents through a transformer with the primary windings in opposite direction. The secondary winding then gives the differential current, which represents the wattless component of the compounded machine and is supplied through the compounding brushes to the compound machine. He then gives several diagrams showing the connections for the compound winding. In general he uses three-phase currents; but for certain numbers of poles, it is necessary to use two-phase excitation, the well-known Scott system being used for obtaining two-phase currents for excitation and for compounding. He gives the results of tests of a 100-hp compound generator of Brown, Boveri & Co. The results show that it is possible to compound or overcompound a machine at will, furthermore by choosing proper values of the transformation ratio of the transformer and a proper position of the brushes, it becomes possible for instance to exactly compound the machine for non-inductive loads, and overcompounded it for wattless currents, etc. At the conclusion of the paper the two types—the compensated uncompounded machine and the compensated compound machine—are characterized as follows: The advantages of the former are the great simplicity, the favorable utilizations of the material, the small exciting current, the substitution of the exciter by a simple and safe commutator of small dimensions, automatic compounding for non-inductive load, the great elasticity and adaptability to any existing installation; either as generator if no wattless currents are required from it, or as motor with a constant power factor equal to unity, it is very suitable for power transmission between similar machines and for parallel connection to existing plants. On the other hand, the compounded machine is character-

ized by greater independence in connection with machines operating in parallel. It is not so clearly non-synchronous as the simply compensated machine. With perfect compounding, speed and number of alternations are nearly synchronous; with overcompounding, the number of alternations may be even greater than the product of number of poles and speed. It is a "universal machine," and is suitable for any plant. It is somewhat larger, the commutator by which the main current is supplied to the rotor being especially so. On account of its approximate synchronism and its absolute constancy of voltages, it is very suitable when used as a single machine; or as main generator and "frequency setter," when used in operation in parallel with other machines. In the latter case he recommends using one or two compound machines, and for the others simple compensated machines.—*Elek. Zeit.*, June 26.

Compound Alternators.—BOUCHEROT.—An abstract of a paper read before the International Society of Electricians, in Paris. His method of compounding alternators by a special exciter has already been described at length in the Digest in connection with the compound machine exhibited by him at the Paris exposition. The compounding effect is theoretically perfect, but in practice it is impaired by the leakage effect. For a high-leakage machine having 92 poles, for instance, with a non-inductive load the compensation was perfect, but with inductive load there was an over-compounding effect. Ordinary machines show no practical differences, however; illustrations of load and speed, of course, result in perturbations, but these can be allowed for just as the effects of hysteresis and heating. This automatic compounding offers an instantaneous compensation much better than the hand rheostat regulation, which is never simultaneous with the variation it is intended to compensate. The exciters used by Boucherot are designed for a comparatively low number of brushes, eight for instance, for 20 or 30-pole alternators. An advantage claimed by him for the compensated alternator is that it can be given a higher inductance and a smaller flywheel than other machines of equal output, and is, therefore, less expensive to build. In the case of paralleled alternators the compounding transformers are grouped in parallel, so that they compound as a whole with reference to the network. Among the compensated alternators in operation in France, he showed photographs of 20, aggregating about 3,000-kw.—Lond. *Elec.*, June 20.

REFERENCES.

Induction Motors.—EBORALL.—A communication in which he gives some critical notes on Meyer's recent article. He agrees with this article in general.—Lond. *Elec.*, June 20.

Reactance Voltage.—HOLM.—A brief communication in which he gives a note on Rothert's formula, recently noticed in the Digest, for calculating the reactance voltage of direct-current machines.—*Elek. Zeit.*, May 29.

Sparkless Commutation.—FISCHER-HINNEN.—A communication in which he gives a practical formula which follows from his theory of commutation.—*Elek. Zeit.*, May 22.

ROTHERT.—A brief reply to the criticism of Dick.—*Elek. Zeit.*, June 5.

LIGHTS AND LIGHTING.

Reichsanstalt Tests for the Nernst Lamp.—An account of official tests made quite recently by the German Reichsanstalt on two specimens of the Nernst lamp, as made by the General Electric Company, of Berlin (which owns the European patents). Two types of lamps were tested, one pattern having a straight, and the other a curved filament. The former of these is the one now on the market, and the latter is an experimental pattern which the company hopes to perfect in a short time. The results of the test of the straight filament lamp are given for the mean of five lamps, at a pressure of 220 volts: after 0, 50, 100, 200, 300, 400 hours the current was 0.264, 0.261, 0.260, 0.253, 0.242, 0.237 ampere, respectively; the candle-power 35.1, 32.4, 32.3, 30.1, 27.5, 26.5; the watts consumed per candle 1.65, 1.77, 1.77, 1.85, 1.93, 1.97. The candle-power, therefore, decreased in 400 hours by 24.5 per cent. The mean consumption of watts per candle is 1.83. One of the filaments burnt out after 310 hours, another after 379 hours, and the remaining three were intact after 400 hours. The mean life is, therefore, over 378 hours. The heating spirals were not damaged. The results of the tests of the other specimen, that with the curved filament, were as follows for a mean of 5 lamps, at a pressure of 220 volts: After 0, 50, 100, 200, 300, 400 hours the current was 0.259, 0.259, 0.259, 0.247, 0.238, 0.219 ampere, respectively; the candle-power 40.1, 36.3, 38.1, 34.1, 33.2, 27.6; the watts per candle 1.42, 1.57, 1.49, 1.59, 1.58, 1.75. The candle-power, therefore, decreased in 400 hours by 31 per cent. The mean consumption of watts per candle in this time was 1.57. One filament burnt out after 150 hours and the other four were intact after 400 hours. The mean life of the filament was, therefore, over 350 hours. The heating spirals of two lamps broke down after 110 and 395 hours, respectively. Therefore the mean life, taking account of the heating spirals, was 291 hours.—Lond. *Elec.*, June 20.

Lighting Miners' Safety Lamps by Electricity.—BROWN.—An abstract of a paper read before the Midland Inst. of Min. Eng. A metallic conductor is fixed in a glass surrounding the wick of the lamp, which is lighted by placing it on a stand having a battery and induction coil inside it. Contact plates are arranged on the top of the stand, and by pressing down the lamp the primary circuit of the coil is closed, causing a spark to pass between the conductor in the glass and the wick tube, this being sufficient to light the wick. It was possible by this arrangement to light an ordinary safety lamp without passing a conductor through the bottom.—Lond. *Elec.*, June 20.

POWER.

Gas Engine Driven Alternators in Parallel.—ROSENBERG.—A very long illustrated article, in the first parts of which he discusses the problem analytically at great length. In the last part he describes an actual installation. In recent years the parallel operation of gas-driven, three-phase machines has become of great importance in such works where the furnace gases were formerly wasted, but are now used in gas engines. In many such plants three-phase currents are preferable to direct-current. He describes such an installation in some iron works in Bobreak, Silesia, as an example that a perfect parallel operation can be obtained with gas engines. The coke furnace gas is utilized in the gas engines. The plant contains six 300-hp three-phase machines; a 50-hp direct-current machine, and two motor generators consisting of a 50-hp three-phase induction motor and a 33-kw direct-current dynamo. The direct-current machines give the exciting current for the alternators, and assist an older direct-current plant for lighting. The three-phase alternators have a power load only, the capacity of the motors connected aggregating 1,500 hp. The "degree of non-uniformity" of speed during one revolution of the machines is 1:150; the magnet system of the dynamo is used as flywheel; both the gas engines and dynamos were installed by the same company. The connection in parallel is done in a very satisfactory way by means of an eddy current brake; there is no difficulty whatever, and the machines may be connected in parallel at any relative position of the cranks of the machines.—*Elek. Zeit.*, May 15, 22, 29.

TRACTION.

Acceleration on the Liverpool Overhead Road.—An illustrated article on the proposed changes of equipment of this road which was equipped a dozen years ago. The total length is a little over 6.5 miles, with double track and a third rail feed, and a special rail return operated by 500 volts direct current; the distance was run in 32 minutes, including 16 stops, or practically at a scheduled speed of 12.5 miles per hour. Recently trials have been made with a new equipment and it was found that the journey can be made in 20½ minutes. The acceleration curves obtained in these trials are given in a diagram. The acceleration reached 4.2 feet per second, or nearly three miles per hour per second. During the acceleration of the train on the series notch of the controller, each motor carried 300 amperes, or three times the normal current; there was no sparking at the commutator. The action of the brakes during retardation is perfect; the negative acceleration reached 4.75 feet per second per second. In the trials, the watt-hours consumed were 137 per ton mile, or about 6.35 kw-hours per train mile run. With the old equipment the watt-hours per ton mile were 110. The results of the trials were so satisfactory that the new equipment will be introduced. Each of the new trains is to be fitted with four 100-hp motors; their efficiency is 93 per cent. at full load; their weight, 4,200 lbs. each. The temperature rise, after one hour's run at full load is 55° C. for the commutator, 57 degrees for the fields, 39 degrees for the armature, 14 degrees for the pinion bearing, and 9 degrees for the commutator bearing. The construction of the motors is described. The following comparison is given of the scheduled speeds with the new Liverpool equipment and those of

the other lines: Liverpool Overhead, 19 miles per hour, including stops; Manhattan Elevated, 13.5; Metropolitan Elevated, 14.1; Chicago South Side Elevated, 14.6; Chicago Lake Street Elevated, 12.5; City and South London, 12.5; Central London, 14.—Lond. *Elec. Times,* June 26.

REFERENCE.

Calculation of Feeders for Electric Tramways.—EENGEL.—A reply to Sieber's criticism, recently noticed in the Digest.—*Elek. Zeit.,* May 29.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Lightning Arresters.—GOLA.—A long illustrated abstract of a paper read before the Milan section of the Italian Electrical Society, on the protection of electric installations against atmospheric discharges. He refers to accidents of a peculiar kind, in which atmospheric discharges destroyed machines, while the line was protected by ordinary lightning arresters, and at times when there was no thunderstorm. The ordinary lighting arresters did not show any sign of having been acted upon. In these cases the path which such discharges take in the dielectrics of the machine was peculiar; it was found that the discharge had gone from a wire of the armature to one or several pole shoes, although this path was much longer than to any part of the earthed case, and also much longer than the air-gap of the lightning arresters. It appeared, therefore, that discharges of this kind are directed by a strong magnetic field and that in such cases large air spaces can be overcome. To protect against discharges of this kind, he devised a new kind of lightning arrester; but as it has not yet the property of interrupting the arc with sufficient rapidity, he used it in conjunction with the old lightning arresters. His new type of lightning arrester is described in detail and illustrated. It may be briefly said to have the form of a hollow ellipsoid, consisting of two halves of iron, separated by a zinc frame; above one half is another half ellipsoid of iron, so that there are two air spaces between the three iron pieces. In these a strong magnetic field is produced. Two pieces of carbon are placed opposite to the rim of the ellipsoid, the distance being adjustable. The exciting coil of the electromagnet is in series with the line. An atmospheric charge, which distributed itself over the surfaces of the apparatus, is driven by the magnetic field to the rim of the ellipsoid and is caused to discharge over to the carbon pieces. These lightning arresters have been installed on a mountain line where in five months four accidents of the type mentioned above had occurred, in spite of the older ordinary lightning arresters. Both types have been used together since May, 1901, and since then no accidents have happened. *Elek. Zeit.,* May 22.

Switch Construction.—MAYES.—A.1 article in which he calls attention to some faults often found in switch construction. There is sometimes a marked want of proportion in comparing the gap allowed between the switch contacts and the arc through which the contact maker is caused to pass when the switch is opened. The difference between the operation of single and double-pole switches is often not sufficiently appreciated, as the same width of gap is often allowed between the contacts whether the switches are single or double pole, for any given voltage; in the single pole switch the gap should, of course, be twice that in the double-pole switch.—Lond. *Elec. Rev.,* June 13.

WIRES, WIRING AND CONDUITS.

REFERENCE.

Wiring for Experimental Work.—STEINTHAL.—An illustrated description of a carefully arranged system of wiring for experimental work, based on the experience gained in the equipment of the new physical laboratories at Owens College, Manchester.—Lond. *Elec. Rev.,* June 6.

ELECTRO-PHYSICS AND MAGNETISM

Canal Ray Ions.—W. WIEN.—An account of an experimental investigation concerning the charges and masses of the ions in canal rays. However high the vacuum, a positive or negative discharge can always be obtained from an electrode kept at a white heat. A glowing carbon filament will discharge negative electrons when charged to —800 volts, and positive ions in the form of canal rays when charged to + 3,000 volts. A platinum wire will go on discharging in a similar manner until its whole substance is worn away. In determining the heating effect of the canal rays and the charges transported by them, he obtained values for the ratio of the charge to the mass of the positive ions in canal rays, which are very much lower than those for the same ratio for the negative electrons in cathode rays. This is not surprising, for so far as we know, positive electrons are always associated with atoms of matter when discharged from solids. The author finds, in addition, that the ratio of the charge to the mass varies within wide limits—say 3,500 and 40,000 absolute electromagnetic units per gramme, as against 10,000,000 in the case of negative electrons. The value for hydrogen ions in electrolysis is about 10,000, and the author draws attention to the possibility of the hydrogen ion being identical with the canal ray ion. Hs is, however, not quite certain of it yet, as he has failed to discover a characteristic variation of the ratio of the charge to the mass for the canal rays, with the atomic weight of the gas.—*Ann. d. Phys.,* No. 6; abstracted in Lond. *Elec.,* June 20.

ELECTRO-CHEMISTRY AND BATTERIES.

Carbon and Diamonds.—LUDWIG.—An account of experiments relating to the fusion of carbon. Under ordinary conditions of heating, carbon, like arsenic and phosphorus, volatilizes without passing into the liquid condition. By the use of a pressure of 1,500 atmospheres he obtained carbon in a non-conducting state, clearly indicating its passage into the transparent liquid condition. The carbon passed rapidly, however, from this state into that of graphite, and experiments proved that this last allotropic form of carbon can be formed either with or without the intervention of the liquid state. Attempts to form diamonds by rapid cooling of the liquid carbon while still under pressure, were not very successful, but he believes that he has solved the problem of the natural formation of diamonds, and that, by following the lines which he has indicated later workers may be successful in producing this form of carbon in the laboratory.—*Zeit. f. Elektrochemie,* May 8; abstracted in Lond. *Elec.,* June 20.

Edison Storage Battery.—JOEL.—A summary of the patents taken out by Edison for different forms of his new storage battery. "Mr. Edison is a worker, and his patents bear evidence of his hard plodding work, and of the patience and perseverance he has given to this subject. He has undoubtedly advanced our knowledge of the alkaline genus tribe of storage batteries, and of the special preparations of metals, copper, iron, nickel and zinc for use with such solutions. The reading of the specifications comes fresh, and brings one up to date."—Lond. *Elec. Rev.,* June 20.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Direct Reading Instruments of Precision.—MARCK.—A communication from the technical department of the Imperial Bureau of Standards in Vienna. He gives a large number of notes concerning the use of modern direct reading electric instruments of precision, such as built by Weston, Siemens & Halske, etc. Among many other things, he remarks that the influence of an external magnetic field is often much greater than one supposes; he, therefore, always takes the arithmetic mean of two readings, between which the instrument has been turned through 180 degrees. When used in dry rooms, care must be taken that single parts of the instrument do not get a considerable static charge. By rubbing the glass of a Weston voltmeter with a clean dry cloth, he has found a change of the reading up to "15 parts of the scale"; blowing with the damp breath from a distance of 20 to 30 cm takes away the static charge. The insulation of the leads must be taken care of. He remarks that in order to diminish the cost, millivoltmeters are sometimes made very sensitive—for instance 150 parts of the scale = 300 mm. = 0.05 volt —and the shunts of small dimensions. In such cases the shunt heats considerably and the binding posts are heated unequally, so that a thermo current is sent into the instrument; in such a case he found this thermo e. m. f. equal to 0.00021 volt, *i. e.,* 0.7 parts of the scale, corresponding to an error of 1 per cent. for a reading of 70 parts of the scale.—*Elek. Zeit.,* May 22.

Measuring Small Self-Inductions.—VARLEY.—An article in which he describes a new method of measuring or comparing self-inductions of small solenoids and coils. The principle of the method depends on the relation between the maximum current obtained when a condenser is discharged through a circuit containing small resistance, and the self-inductance in circuit. This maximum current is then V multiplied by the square root of the ratio of C to L, when C is the capacity of the condenser, L the self-induction, and V the potential difference between the condenser plates before discharge. If we

keep the capacity constant and charge the condenser to the same potential every time, then the maximum current is inversely proportional to the square root of the self-induction in the discharge circuit; and by comparing the values of the current for different self-inductions, we can compare the latter with each other; for absolute instead of relative measurements, a standard known self-induction is necessary. As the method is a comparative one, it is not necessary to know the absolute values of the quantities measured. The condenser is best charged from the secondary of an induction coil through the primary of which an alternating current of 4 or 6 amperes is passed, and it is allowed to discharge through a spark-gap of 1 mm. or 2 mm., which ensures the potential being very nearly the same for each discharge. The maximum current is measured by passing it through a solenoid which is used to deflect a beam of cathode rays in a Braun tube. The method is described in detail, and a numerical example is given.—Lond. *Elec.*, June 20.

Measurement and Calculation.—WOODWARD.—While at present the units of length, mass and time are assumed as the fundamental units (c. g. s. system), it is by no means certain that these units will best satisfy the requirements of science in the future. It seems rather probable that advancing knowledge will find some other system of units preferable if it does not find several different though interconvertible systems essential. We have, in fact, already attained two such diverse systems in the units of electromagnetic science. He shows how different systems can easily be constructed, for instance by using energy mass and time, or energy length and mass, instead of length mass and time as the fundamental units; the dimensions of several quantities in these three different systems are given in comparative tables. He says that "it is to be hoped that the end of the barbaric system of 'weights and measures' we have inherited from an unscientific ancestry is near at hand, and this not so much in the interest of men of science as in the interests of those less well fitted to struggle with the ingenious intricacies of the British system." He describes the standards of meter and kilogram. The time unit is the least stable of our three fundamental units, and hence the most in need of checks on its stability. He then discusses the measurements of quantities of all sizes, from the dimensions of corpuscles and atoms up to the distances between the stars.—*Science*, June 20.

Röntgen Ray Apparatus.—ROLLINS.—The first part of a well illustrated serial on "apparatus for X-light diagnosis." He urges that the following precaution should always be taken in X-light work. The X-light tube should always be used in a non-radiable case, from which no X-light can escape except the smallest cone of rays which will cover the area to be examined, treated or photographed. The fluorescent screen should be covered on the side nearest the eyes with a sheet of heavy lead glass one centimeter thick, because the fluorescent salt allows much of the X-light to pass through it unchanged. All parts of the fluoroscope, except the screen, should be heavily painted with non-radiable paint. The physician should wear spectacles of lead glass one centimeter thick. He describes the construction of non-radiable cases for X-light tubes; the arrangement of spark-gaps, and a simple form of examination table.—*Elec. Rev.*, June 14.

TELEGRAPHY. TELEPHONY AND SIGNALS.

Selenium Telautograph.—KORN.—An illustrated description of an instrument for the reproduction of images at a distance. It is based upon the sensitiveness of the vacuum discharges at an exhaustion of 0.2 to 2 mm., to slight changes in the resistance of the circuit, and the extraordinary photo-chemical activity of the rays proceeding from the discharge tube. The picture to be transmitted is divided up into small squares, each of which is projected in turn upon a selenium cell. At the receiver end a sensitive plates is made to move past an aperture transmitting the Rontgen-rays, the plate moving at a rate corresponding to the motion of the original picture at the sending end. The variations in the current produce a variation in the size of a spark-gap, which in turn produces a corresponding variation in the actinic intensity of the vacuum tube. A period of two seconds suffices to give a good impression of each square. The way in which the spark-gap is shortened is as follows: An astatic galvanometer carries, in addition to the two needles, a small brass needle acting as one of the electrodes of a spark-gap. The greater the deflection of the galvanometer, owing to the illumination and consequent lowering of the resistance of the selenium cell, the more does the brass needle approach a fixed needle representing the other electrode. One of the electrodes of the vacuum tube is attached to the fixed needle, while the other electrode is put to earth, and the movable needle is connected with one of the poles of the secondary coil of a Tesla apparatus. The second pole of the Tesla coil is connected with a large capacity. He has worked successfully with pictures consisting of 400 squares. He proposes to reduce their size to 1 sq. mm. in the transmitter, and the exposure to tenths of a second. The original contains reproductions of a few simple geometric figures, which were transmitted in this way.—*Elek. Zeit.*, May 22; abstracted in Lond. *Elec.*, June 6.

Castelli Coherer.—An illustrated description of the Castelli coherer, which is used with good success in the Italian navy, and which in an improved form is stated to have been used by Marconi in his well-known attempts to signal across the Atlantic. Castelli's tube, as shown in the adjoining Fig. 1, consists of two carbon electrodes enclosing two drops of mercury separated by a small iron cylinder. This tube is self-decohering. The receiving arrangement used in the Italian navy is shown in Fig. 2, in which *G* is a bell, *H* a relay, *A* telephones, *R* an induction coil, *L* a bell switch, and *E* a lightning protector. In practice the Castelli coherer ensures regularity and rapidity of communication to much greater distances than when other coherers are sue d.For a good tube carefully adjusted, the e. m. f. of the cell should be from 1 to 1.5 volts. Considerable moisture in the atmosphere has an appreciably injurious effect on the tubes which are not perfectly closed. In the mercury tubes the self-decoherence is more or less perfect according to the purity and freedom from amalgam of the mercury used, to the dryness and cleanliness of the interior of the tube, and to the smallness of the drops of mercury. The most suitable diameters of the drops are comprised between the extreme limits of 1.5 mm. and 3 mm. Drops less than 1.5 mm. in diameter give insentitive tubes; those greater than 3 mm. diminish the completeness of the decoherence. The diameters of the tubes must be proportional to the drops of mercury used; in general they are 3 mm. in internal and 5 mm to 8 mm. in external diameter. These tubes must be regulated by the telegraphist on duty, and after a certain time they lose their good qualities, but the telegraphist can readily dismount the tube, clean it, and put in fresh mercury, taking all the necessary precautions for obtaining absolute cleanliness—*L'Elettricista*, May; *Lond.* Elec., June 27.

FIG. 1.—CASTELLI'S COHERER.

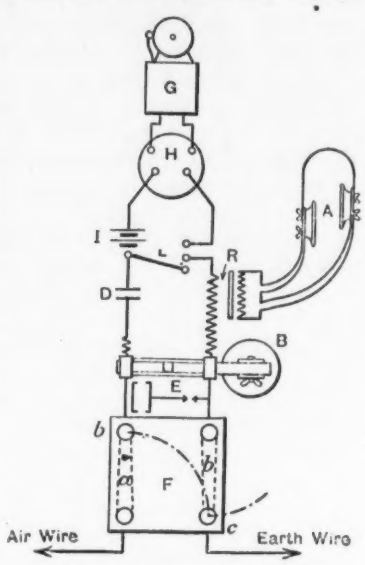


FIG. 2.—CASTELLI'S COHERER.

New Book.

THE ELEMENTS OF PHYSICAL CHEMISTRY. By J. Livingston R. Morgan, Ph. D. Second Edition, revised and enlarged. New York: John Wiley & Sons. 352 pages, 23 illustrations. Price, $2.00.

This treatise is an extremely comprehensive one, embracing practically all the elements of physical chemistry, together with the important and but little known applications to the other branches of chemistry. This is made possible by a free use of mathematical formulas and symbols, which enable the author to express relations in a brief and concise way, while otherwise he would have had to use many words to express them completely. This shows the wisdom of the claim that a mathematical training is considered indispensable for the modern chemist.

The book is divided into ten chapters. In the first he gives some introductory remarks on physical chemistry, energy and the methods of determining the atomic weight. The second, third and fourth chapters deal with the gaseous state, the liquid state and the solid state, erspectively; the fifth chapter takes up solutions; the sixth

gives a brief outline of thermochemistry, while the seventh on "chemical change" is divided into three parts—the conditions of chemical equilibrium and the law of mass action; the rôle of the ions in analytical chemistry; and chemical kinetics.

The author is an adherent of the orthodox, modern, electrochemical school—that is, of the dissociation theory—but his views on the part taken by the ions in analytical chemistry might be greatly modified in view of Kahlenberg's recent important and striking researches on instantaneous chemical reactions in non-conducting liquids. The eighth chapter gives a brief statement of the phase rule of Gibbs, while the ninth deals with electrochemistry, and is divided into four parts—on the migration of the ions; the conductivity of electrolytes; electromotive force and the ionic mechanism in galvanic cells; electrolysis and polarization. The last chapter gives a useful collection of problems with answers.

The book seems to be chiefly a text-book for colleges, and appears very sutiable for that purpose. The author hopes that it may also be used to advantage by those studying the subject without an instructor; he says "the physical meaning of all relations is shown, so that those who have not sufficient mathematical training to actually derive the single relations will at least understand them and be able to apply them when necessary." In the reviewer's opinion, however, this should be done only with great caution. Engineers know the serious consequences which may result when one tries to apply a formula without knowing exactly whence it comes, unless its application is very fully and clearly described and all its limitations stated; otherwise a formula on any engineering subject can only be completely understood if its derivation is known, as then only do all its essential conditions become clear. It is the same in physical chemistry. Only those who take pains to see how the results have been reached can understand them thoroughly, and whoever has not sufficient training for this purpose had better not attempt their application, unless all the limitations and applications are clearly stated.

The author is sometimes a little careless in his definitions. For instance, on page 2 he says: "At Washington a body falling freely for one second acquires the velocity of 980.10 centimeters," whereas he should have said, "centimeters per second." A few lines below he uses the word "dynes" when he should have said "dyne-centimeters" or ergs.

Directory of Electrical Societies, Etc.

AMERICAN ELECTOCHEMICAL SOCIETY. Next meeting, Niagara Falls, N. Y., Sept. 15, 16 and 17, 1902.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Detroit, Mich., Oct. 8, 9 and 10, 1902.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Next meeting. September, 1902.

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Annual meeting, Hotel Kaaterskill, Catskill Mountains, N. Y., Sept. 2, 3 and 4, 1902.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Toronto, Ont., 1903.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Richmond, Va., Oct. 7, 8 and 9, 1902.

NEW YORK STATE STREET RAILWAY ASSOCIATION. Next meeting, Caldwell, N. Y., Sept. 9 and 10, 1902.

OLD-TIME TELEGRAPHERS' ASSOCIATION AND UNITED STATES MILITARY TELEGRAPH CORPS. Next meeting, Salt Lake City, Utah, September, 1902.

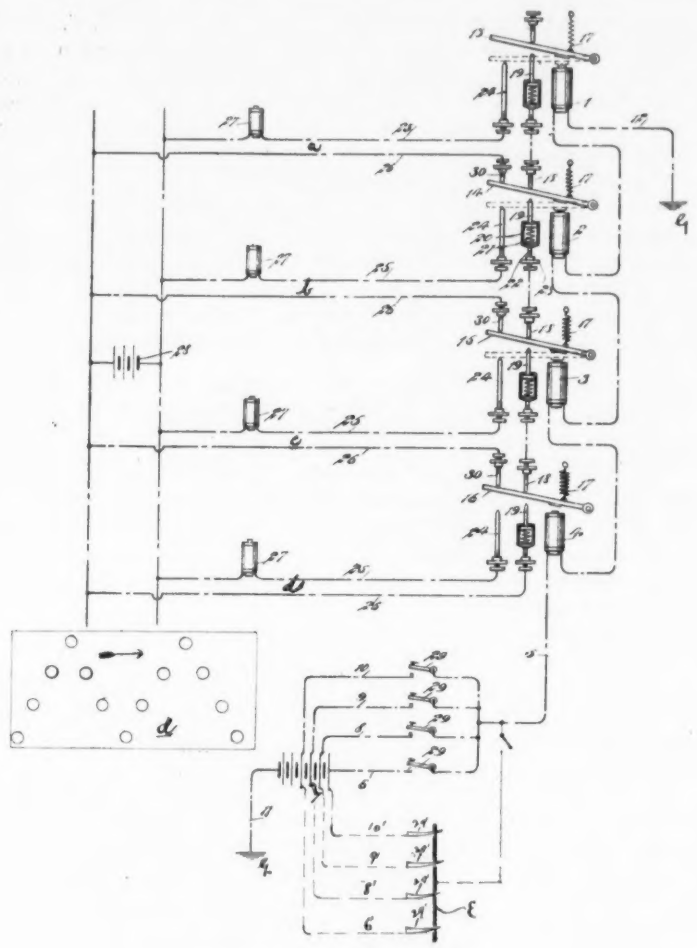
A New Multiple Telegraph.

BY S. T. FOSTER, JR.

IN view of the present discussion as to the advantage and disadvantage of machine telegraphy, some of your readers may be interested in the details of a multiple-telegraph system which the writer has recently devised and which involves a very simple arrangement.

Referring to the accompanying illustration, the receiver is shown as consisting of a number of controlling devices in the form of electromagnets connected in series in main line, 5. Though only four are shown, as many can be employed as may be required—for instance, one for each character to be transmitted, one for the space, one for line shifter, one for typewriter carriage shifter, etc. The several controlling devices are of different resistances; that is, of different number of turns on the magnets, or of different tensions on their armature levers, so that each requires a different current strength to operate it. For example, electromagnet 1 will require a certain predetermined current strength to energize it sufficiently to operate its armature; 2 a greater current strength to operate its armature, and thus the current required is increased throughout the whole series of the electromagnetic controlling devices.

There is a keyboard, 29, for connecting into the circuit different amounts of battery. The circuit is grounded after passing through all electromagnets, 4, 3, 2, 1, and ground wire 12. At the sending end the line-wire is grounded through the keyboard, 29, battery, and ground wire, 11. Completing the circuit through 10, there is enough voltage to overcome the resistance of the line and to force enough current through the whole circuit to operate 1; completing the circuit through 9, there is enough voltage to overcome the line resistance and to force enough current through the circuit to operate 2, and more than enough to operate 1, so that both 1 and 2 will operate simultaneously. Likewise, completing through 8 will cause 1, 2 and 3 to operate and to pull down their respective armature levers simultaneously; similarly, only one pulsation of current will cause any of the controlling devices (together with all those below that one in the series) to operate.



MULTIPLE-TELEGRAPH SYSTEM.

When operated, the armature lever of each controlling device is designed to close a local circuit containing a translating device and to open the local circuit closed by that controller next below it in required current strength.

Assume the main circuit is completed through 8, then 1, 2, and 3 will operate their respective armature levers, 13, 14 and 15, as shown by dotted lines; 13 will close the local circuit *a*, between 19 and 24; 14 will open this local circuit between 30 and 18 and will close local circuit *b* through its 24 and 19, and thus similarly 15 will open the local circuit *b* and close local circuit *c*; and, 4 not operating, local circuit *c* will remain closed through 30, 16 and 18, so that local circuit *c* will be the only one completed. Hence, by closing the main circuit

through 10, only the local circuit *a* is completed; by closing the main circuit through 9, only the local circuit *b* is completed; and so on.

Translating devices 27 may be electromagnets, and one each made to operate a key of a typewriter, one to shift spacer, one to shift carriage, etc., and each operated independently of all others from a distant station with only one pulsation of current for the operation of each one. The keys for cutting in different voltages on the main line may be conveniently arranged similar to the keys of a typewriter.

Different amounts of battery power may be automatically thrown in circuit according to the local circuits to be operated, by having a strip of paper punctured properly, and passed between a copper strip, *e*, and contractors, 29'. The punctures should be so arranged that only one will pass over the copper strip, *e*, at a time, and their respective positions across the paper will determine by which of the connectors, 29', the main circuit will be completed, and, therefore, the battery strength cut in.

A paper strip, *d*, is punctured so that if it is run in between *e* and connectors, 29', and in the direction of the arrow, then the battery will be cut in successively through 6', 8', 9', 10', 9', 8', 6', 8', 9', 10', 9', 8', 6', which will cause local circuits at the receiving station to be completed successively in the same order, *d, c, b, a, b, c, d, c, b, a, b, c, d*. A machine can easily be devised, something after the fashion of a typewriter for puncturing the paper strip, each key to puncture in a certain relative position across the page.

The advantages of this system are as follows: For each pulsation of current through the line, a letter, figure or other character may be printed on a typewriter; a typewriter or a linotype machine may be worked rapidly from a distance by the manipulation of a keyboard or by pulling a previously prepared strip of paper through a slot; there are no wheels nor gears to get out of order except such as are in the machine selected to be operated by the translating devices, 27.

Weston Duplex Instruments.

The accompanying illustrations show a type of combined voltmeter and ammeter now being made by the Weston Electrical Instrument Company. These instruments are particularly useful where practically simultaneous readings of current voltage are made, and also in all cases where space is limited and compactness is a necessary or desirable feature.

The two instruments are enclosed in a neatly designed water-proof aluminum case, which closely surrounds the operative parts of the instruments. The use of an aluminum case secures a minimum weight as well as size, and as the case is water-proof, this model is well adapted for outside use, where the instrument is exposed to the weather, or in other cases where water or dampness would be likely to affect the working of the instrument. They are particularly suitable for use on electric vehicles on account of extreme lightness, compactness and freedom from danger of injury by water, snow, mois-

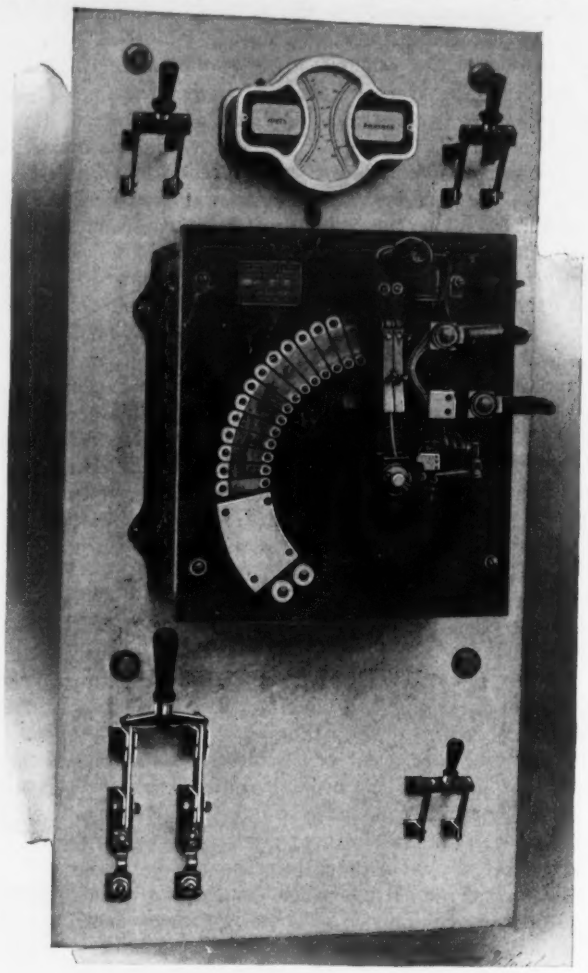


FIG. 2—DUPLEX INSTRUMENT ON SWITCHBOARD.

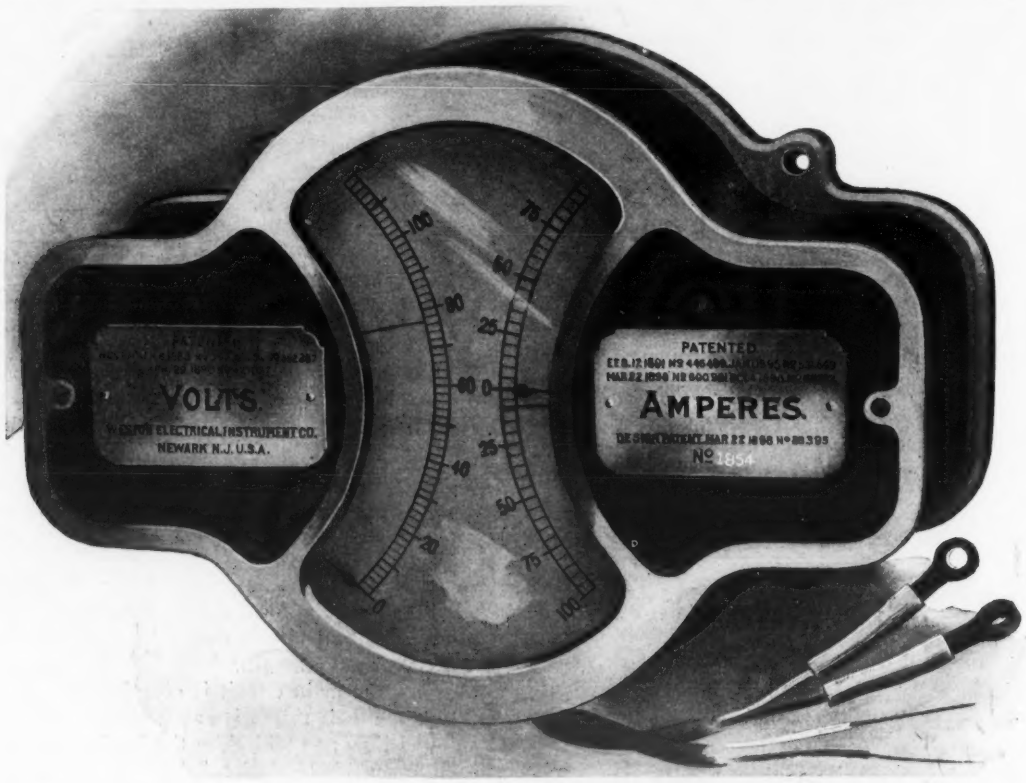


FIG. 1.—COMBINED VOLTMETER AND AMMETER.

ture or dust and dirt. The dimensions and weight are as follows: Length, 9½ inches; width, 7 inches; height (or depth), 3¼ inches; weight (without shunt), 8 pounds. These instruments were originally designed for automobile service, and the whole instrument, and especially the moving parts, being so designed and constructed as to be able to bear without injury the constant vibration to which such instruments are subjected while in use on vehicles. Aside from their adaptability to use on vehicles, the instruments are also particularly well adapted for use in all other cases where extreme vibration is met with, or where space is very limited, and lightness a desirable or necessary feature; as for use on small switchboards, and especially on motor-starter switchboards, where they will be found to render valuable service in indicating the power used in driving single machines or groups of machines. Fig. 2 shows their application for this purpose. By their use in this manner it is easy to ascertain the power used to drive machines, and thus to charge the proper proportion of power to each department, or even to each machine. They also serve, when so used, to indicate abnormal conditions arising from friction or other causes, and will thus be found to materially aid in securing economy of operation of machinery in general.

Another model has working parts precisely the same as used in that illustrated, except that the scale is larger, and consequently the divisions more open for the same range, and the case is made of cast-iron, is not water-proof, and does not closely surround the working parts of the instrument. This latter model is well adapted for use in small isolated plants, and for all cases where the existence of powerful external fields would render it impossible to use the other model. The function of the cast-iron case is to shield the instrument from external fields.

Niagara Developments.

A notable and important step in connection with the power development at Niagara Falls has been taken by the Niagara Falls Hydraulic Power and Manufacturing Company in the purchase of a large tract of land in the northeast part of the city, where a new industrial center will be established by that company, its present lands being well occupied by manufacturing plants. Electric power will be transmitted to the newly acquired territory, and Niagara Falls will soon have great factories on its northern as well as on its southern outskirts.

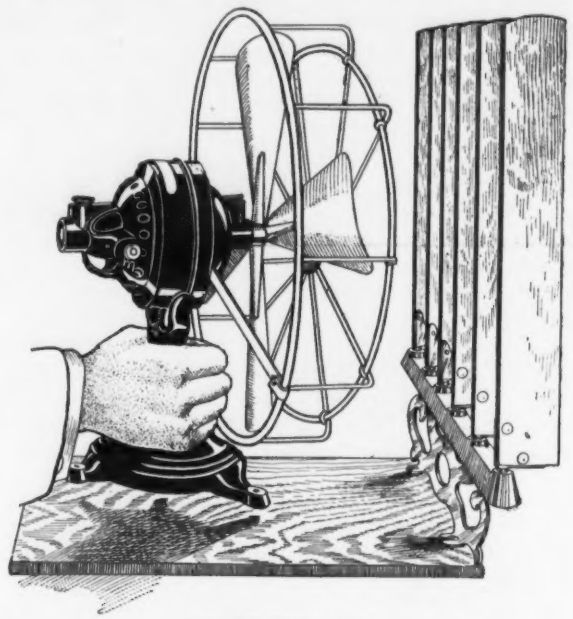
The first large industry to seek this new section will be the Carter-Crume Company. This company has purchased five acres in the same portion of the city and will at once erect a large factory building for the manufacture of counter check books. The buildings will cover about four acres. The Carter-Crume Company now has a large establishment on Main Street, and is a power customer of the Niagara Falls Hydraulic Power and Manufacturing Company. It now employs about 300 hands, but this number will be increased in the new plant, which will go forward at once.

When the Carter-Crume Company vacates its present large buildings, they are to be occupied by the William A. Rogers, Ltd., manufacturers of hollow ware. This company has a plant adjoining the Carter-Crume Company, and when it secures its additional space the company's other plants, in Northampton and New Bedford, Mass., as well as in Oneida, N. Y., will all be moved to Niagara Falls.

The Atmospheric Products Company has broken ground on the lands of the Niagara Falls Power Company, for a building that is to be 125 x 50 feet, two stories high, and of pressed brick. In this building the apparatus necessary to equip a second building to be 500 x 50 feet at the foundation will be made. The first building will be close by the aluminum plant, but the site of the second building is yet to be selected. The Atmospheric Products Company will use air as its raw material.

Air Diffusing Fan Motor.

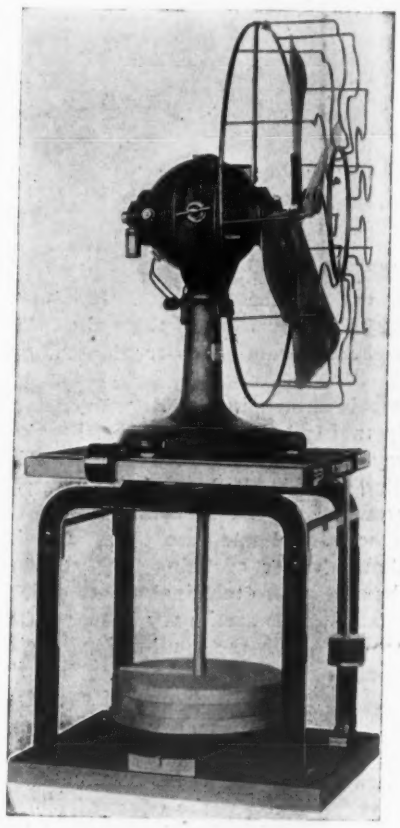
Probably no device for adding to comfort in hot weather has become more universal and popular than the fan motor, and most people are interested in any effort made to improve its efficiency and general utility. One of the latest ideas of improvement has been that of varying or controlling the directions of the fan motor breeze, and we ilustrate herewith the device put forward by Degge & Musick, of St. Louis, Mo. It is so obvious and simple as hardly to need any explanation after a glance at the cut. The Degge "air diffuser," as shown, can be attached to any fan already owned by an individual or on the market. The blades remain steadfast at any angle as fixed, and can be readily swung and set in any new direction when a change of position or direction is required. It will be seen that the diffuser takes the breeze from the fan blades and may deliver it at two distinct parts of any room, so that a generous distribution is obtainable by such feathering; or the blades can all be set at the same angle;



AIR-DIFFUSING FAN.

or a person can still enjoy the breeze while intercepting direct currents that he may dislike to have leveled at his person, causing a cold or chill in the eye or ear. The device is not less simple than inexpensive, and is an ingenious attempt to meet the problems of air circulation in hot weather.

A New Fan-Motor Balance.



MOTOR BALANCE.

The useful work of a fan depends upon the pitch of the blade. Some fans run at a high speed and with little noise, but a purchaser soon learns that very little air is moved, the pitch of the fan blades being so small that the power demanded of the motor and the breeze produced are far below expectation.

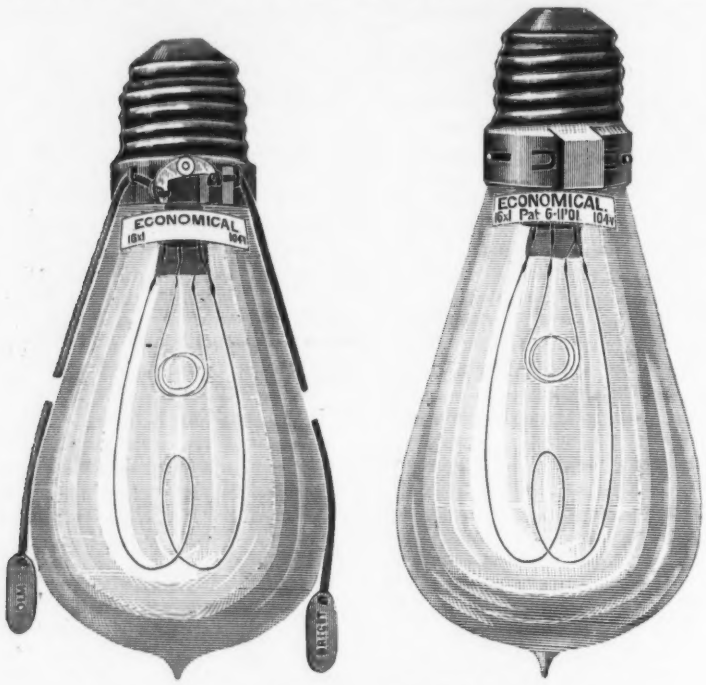
The accompanying illustration shows a new instrument for measuring the useful work of a fan. Its design is based on the well-known law that action and reaction are equal and opposite in direction. The force exerted in moving air forward is exactly equaled by the backward thrust on the fan, which is accurately weighted by this instrument.

In conjunction with the measurements of the electric current used, this gives also the practical efficiency of the fan motor. This instrument was constructed by the Sprague Electric Company, and is in use by it to show the high power, large air moving capacity and high efficiency of its fan motors.

Regulating Incandescent Lamp.

The problem of producing an incandescent lamp, the light of which can be varied at will and economically, as easily as a gas jet is controlled, has received the serious attention of many inventors. The lamp illustrated herewith represents the latest idea in a turn-down lamp and possesses the important qualification of being economical in current per candle-power when it is turned down. It gives two degrees of light, viz.; full candle-power or one candle-power, the latter being sufficient to light a room enough to enable one to move about without danger of running into and upsetting furniture, etc.

Fig. 1 represents a lamp designed to be used in any fixture, with all styles of shades and in any position, the operation of changing from one degree of light to the other being performed by the aid of two strings suspended from the lamp base. Pulling one string gives the full candle-power and a pull on the other turns on the one candle-power light. The light can thus be changed without touching the bulb, by simply pulling on one string or the other. On the outside of the base a little switch is provided, which cuts in one or the other filament according to which of the strings is pulled. There are three terminals, the base of the lamp constituting the common terminal for one end of each of the two filaments, the second and third terminal



FIGS. 1 AND 2.—REGULATING LAMP.

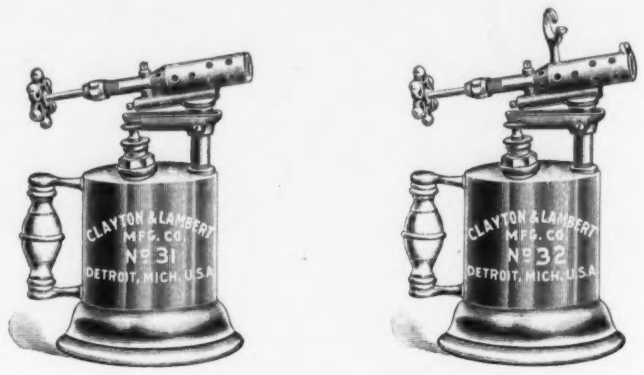
points representing the other ends of the filaments. It is evident, therefore, that according to the position of the switch the current flows through either the full candle-power filament or that of one candle-power.

Another design of this lamp is shown in Fig. 2. Variation of light is effected by simply taking hold of the bulb with the fingers and turning it one way or the other. The base of this lamp is provided with a sliding outside shell, the latter constituting the base, which is screwed into the socket in the usual manner. When the base is screwed home into the socket it remains firmly in place without danger of being loosened by vibration. The sliding shell bears the two terminal points which shift positions under the contact on the stationary base, as the lamp is turned by the hand, whereas in the "pull-string" style the small switch, which is constructed on the "walking beam" principle, forms contact at the lower end with one of the filament terminals. Thus while there is a difference in construction, the results are the same in either case.

It is evident from the construction of this lamp that the danger of its working loose from the socket by the effect of vibration is entirely obviated. The lamp is, therefore, especially adapted for use on steamboats and in other places where vibration is excessive. These lamps are made in two sizes, 8-1 and 16-1 candle-power, and for all standard sockets, by the Economical Electric Lamp Company, 123 Liberty street, New York.

Torches.

The torches illustrated herewith have recently been brought out by the Clayton & Lambert Manufacturing Company, Detroit, Mich. The torch shown in Fig. 1 was designed for the use of mechanics who desire a powerful burner capable of doing heavy work out of doors in cold or windy weather. It is claimed to have great generating power. It produces a clear, blue, intensely hot flame, which is under perfect control of the operator, and is economical in the use of gasoline. The



FIGS. 1 AND 2.—TORCHES.

tank is quart size, drawn out of heavy brass, free from seams, and all fittings are heavy. A brass air pump of the latest design screws into the tank and is submerged in gasoline, which aids in keeping it cool and also protects it from injury. In Fig. 2 the torch is provided with a hook and support, so that soldering coppers may be heated, making it particularly valuable to repair men and mechanics who are called upon to do work of this kind.

Oil Cup for Automobiles.

A form of oil cup, especially adapted for automobiles, has been brought out by Charles H. Besly & Co., 10-12 North Canal Street, Chicago. It is here illustrated, and, as will be seen, is similar to their regular Badger cup, except that it has double depth or capacity,

OIL CUP.

and that the stem is made proportionately longer. The cup is made of cast-iron and can be operated by hand or wrench. The base has a round thread and will not strip, clog or cross. The stem being made of bar steel, drilled and threaded, will not break off in the oil-hole.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Time money was in fair demand, the closing rates being 4½@5 per cent. for all periods. On the stock exchange prices were stronger, on a favorable interpretation of the Government crop report; the activity, however, was on a somewhat restricted scale. It was intimated during the week that the litigation against the United States Steel Corporation might have a speculative origin, and the reported intention on the part of the company to combat such attacks affected the steel stocks favorably. Western Union suffered a drop of several points on rumors that the Vanderbilt interests might take action against Missouri Pacific, which action would affect adversely Western Union and other Gould properties. Traction shares were, on the whole, neglected, although Manhattan shared in the temporary depression of the Gould securities. Metropolitan Street Railway dropped 1⅝ net, closing at 147½, the week's sales being 4,200 shares. Brooklyn Rapid Transit fluctuated within a range of 1½ points, closing at 67¾, a net loss of ⅛ point. General Electric showed some strength on limited trading, the total sales being 1,600 shares. The closing price was 318, which was also the highest figure reached during the week, the lowest being 305. This stock made a net gain of 5 points. Western Union closed at 85½, a net loss of 2¼ points, the sales aggregating 25,483 shares. Westinghouse securities, common and preferred, were quiet, the quotation of the former being 208 and of the preferred 213, the latter representing a net loss of 4 points. American Telephone & Telegraph made a net gain of 4 points, closing at 167, "rights" closing at 15⅛. In Boston, American Telephone & Telegraph made a net advance of 2¼ points during the week. Following are the closing quotations of July 15:

NEW YORK

	July 8.	July 15.		July 8.	July 15.
American Tel. & Cable..	—	—	Gen. Carriage (n. st'k)..	—	—
American Tel. & Tel....	—	—	Hudson River Tel.....	—	107
American Dist. Tel....	—	36	Metropolitan St. Ry....	147⅝	148¼
Brooklyn Rapid Transit.	67½	68¾	N. E. Elec. Veh. Trns..	—	—
Commercial Cable	—	160	N. Y. E. V. T. Co.....	12	12
Electric Boat	30	25	N. Y. & N. J. Tel.....	—	175
Electric Boat pfd.....	50	40	Tel. & Tel. Co. of Am..	—	—
Electric Lead Reduc'n..	2¾	2⅝	Western Union Tel.....	87¼	86½
Electric Vehicle	6½	6*	West. E. & M.	—	208
Electric Vehicle pfd....	14	14½*	West. E. & M. pfd....213		213
Gen. Electric ex. stk. div.	—	192			

BOSTON

	July 8.	July 15.		July 8.	July 15.
Amer. Tel. & Tel. ex. rts.	166	165	Mexican Telephone	2¼	2
Cumberland Telephone..	—	—	New Eng. Tel. ex rts...	141	—
Edison Elec. Illum.....	—	—	Westinghouse Elec.	104	—
Western Telephone pfd.	103	—	Westinghouse Elec. pfd.	105	—
General Electric new...	185	—			

PHILADELPHIA

	July 8.	July 15.		July 8.	July 15.
American Railways.....	46	46	Phila. Traction	98¾	99⅛
Elec. Storage Battery...	—	95½	Phil. Electric	5⅛	5⅛
Elec. Storage Bat'y pfd.	90¼	94½	Pa. Elec. Vehicle.....	—	1
Elec. Co. of America....	5⅜	6	Pa. Elec. Vehicle pfd...	—	3

CHICAGO

	July 8.	July 15.		July 8.	July 15.
Central Union Tel.....	—	—	National Carbon pfd...	102	102
Chicago Edison 179		—	Northwest Elev. com...	—	35⅝
Chicago City Ry.....207¾		208	Union Traction	14⅜	15
Chicago Teleph. Co.....	—	170	Union Traction pfd.....	51¼	49
National Carbon	26	29¼			

* Asked.

UNITED POWER AND TRANSPORTATION.—It is stated from Philadelphia that the new stock issue of the United Power & Transportation Company, decided upon some time ago, has now been allotted and completely taken up. The issue was 18,750 shares, which, at the par of 25, has brought into the company's treasury $568,750. President Rigg, of the United Power and Transportation Company, says: "The gross earnings of the company for the six months ending June 30 aggregated nearly $2,000,000, showing a gain of about $100,000 over the figures for the first six months of 1901. The company will within 30 days commence the building of a line eight miles long from Limerick to Boyertown, connecting our Schuykill Valley and Oley Valley roads at a cost of from $250,000 to $300,000. When this link has been completed we will have a through line from Roxborough to Reading. The Reading and Lebanon roads, both of which we own, come within five miles of connecting. This gap also we have planned to close in the near future, which would take us to Palmyra, within nine miles of Harrisburg."

STORAGE BATTERY OUTLOOK.—A cable dispatch from London, of July 10, says: At a meeting of the shareholders of the Electrical Power Storage Company to-day, the chairman alluded to the persistent rumors about the new accumulator invented by Edison. He said he thought it was too early to place any reliance on statements which had been evidently circulated by irresponsible persons. The chairman said that the company had followed Mr. Edison's figures closely and was unable to find, even on his own statements, that he was able to make a battery more than 10 per cent. lighter than the special battery made by the Electrical Power Storage Company, and it was about two or three times more expensive in manufacture. It would have to last a long time, the chairman said, if it were to come into competition with those which the company was now selling. Judging from his own experience, the chairman said, he thought it might be found that Edison was still far from being in a position to make a commercial article of his invention.

GEORGIA RAILWAY AND ELECTRIC.—The Georgia Railway & Electric statement for the month of May shows an increase of about 7 per cent. over the preceding month, and for the five months of 1902, ending May 31, an increase of 20 per cent. over the same period last year. The May earnings are: Gross, $107,387.19, as compared with $90,283.34 for May, 1901, an increase of $17,103.65; net, $56,333.39, showing an increase of $14,355.80 over 1901. The proportion for interest and taxes is $38,598, leaving $17,730. Of this, $7,500 is necessary for preferred stock, leaving a surplus of $10,230 for common stock. In view of the fact that this corporation was only formed January 1, 1902, consolidating the Atlantic Railway & Electric Co., Atlantic Rapid Transit Co., Atlanta Steam Co., and Georgia Electric Light Co., this statement is considered excellent.

JOHNSON TROLLEY INTERESTS.—It is stated that in order that the management of the Johnson trolley syndicate in the East may be controlled with more ease than formerly, the Trenton, Lawrenceville and Princeton, the Princeton Street Railway, the Yardley, Morrisville and Trenton, Newtown and Yardley Street Railways have been consolidated with the New Jersey and Pennsylvania Traction Company, which concern controls the Lehigh Valley lines in Pennsylvania. Each line will maintain its original individuality, though the officers become subordinate to the directorate of the New Jersey and Pennsylvania Company. The company will raise its capital from $1,000,000 to $3,000,000, and Jilson J. Coleman, who has long been in charge of the Johnson lines in this section, and who is a brother-in-law of the mayor of Cleveland, will be president of the directorate.

DIVIDENDS.—The directors of United Gas and Electric Company, of New Jersey, have declared the initial semi-annual dividend of 2½ per cent. on the preferred stock, payable July 15. The directors of the American Light and Traction Company have declared the regular quarterly dividend of 1½ per cent. on the preferred stock, payable August 1. The directors of the Harrisburg Traction Company have declared a semi-annual dividend of 2½ per cent. out of the earnings of the first half of the year. The trustees of the Worcester Railway & Investment Company have declared a regular semi-annual dividend of $2.25 per share, payable August 1.

GENERAL ELECTRIC'S NEW STOCK.—The $16,812,600 new General Electric stock, representing a dividend of 66⅔ per cent., which was distributed among the old shareholders, is now dealt in on the New York Stock Exchange. The old stock closed at 315 on July 15, and the price of the increased issue started off at 189¼, or ¼ above the old level, allowing for the increase, and advancing to 195½ before noon. The old stock sold ex-dividend of $2 in cash on July 1.

B. R. T. MORTGAGE.—A mortgage of $150,000,000 made by the Brooklyn Rapid Transit Company to the Central Trust Company, of Manhattan, which covers all the property of the Brooklyn Rapid Transit Company, the Brooklyn Heights Railroad Company and the constituent companies, has been filed in the Register's office in Brooklyn. The mortgage is secured by bonds. This mortgage was authorized by the board of directors of the Brooklyn Rapid Transit Company at a special meeting, held on March 20 last, was executed and bears date of July 1, and is signed by President Greatsinger. The object

of the mortgage is to furnish the Brooklyn Rapid Transit Company with money as needed for construction and betterments, and to take up underlying mortgages as they mature. Bonds to the amount of $5,000,000 have already been sold, but none of them have been issued. President Greatsinger states that some of the money would be used in the new Third Avenue power house and some would be used for rolling stock and other improvements. He said there was also talk of extending various lines.

SPRAGUE GENERAL ELECTRIC DEAL.—It was stated that a slight modification has been made in the terms that the General Electric Company offered several weeks ago to the security holders of the Sprague Electric Company for their holdings. The new terms are somewhat less than the original terms, although the offer is looked upon as still a very advantageous one for both parties in interest. The original offer was based upon the Sprague Company showing a certain percentage of earnings, which an examination, made subsequently, failed to show fully. For this reason the General Electric Company has reduced its offer. The new terms are stated in a circular that John Markle, president of the Sprague Company, has sent to the bondholders and shareholders of the company under date of July 10. In it he notifies them that the option was not exercised by the General Electric Company, because of a disagreement as to the price of the properties to be taken over, but that he has entered into a contract with the General Electric Company and with the United States Mortgage and Trust Company under the terms of which, if two-thirds of the Sprague bonds and two-thirds of the Sprague stock are deposited with the United States Mortgage and Trust Company before September 30, the General Electric Company will pay certain specified prices for the company's bonds and stock. The proposed plan for the acquisition of the Sprague properties carries with it a payment for their holdings in Otis Elevator Company stock, a proportion of which is owned by the Sprague Company. The last-named company some time ago, as is well known, sold the elevator manufacturing branch of its business to the Otis Company, receiving in payment a block of Otis securities, which has since been in its treasury. Although President Markle's circular has been just issued, it is stated that a majority of the Sprague securities has already been deposited under the new terms. It is stated that under the modified offer, each Sprague 5 per cent. bond will receive $540 in cash and 5½ shares of Otis Elevator preferred. Sprague preferred will receive $100 in 3½ per cent. 40-year gold debenture bonds of General Electric, redeemable at par within ten years, and thereafter at 105. Sprague common will receive 41.9 per cent. in Otis Elevator common. With regard to the change in the terms, while the General Electric acquires an excellent manufacturing business in the Sprague property, one of the chief assets acquired consists in the fundamental Sprague multiple unit patents.

WESTERN UNION.—There appears to be good authority for the statement, says the *Wall Street Journal* that the Western Union Telegraph Company has recently been a large purchaser of telegraph instruments and materials, and that it is proposed to practically duplicate whatever new lines the Postal Company may construct in what has heretofore been Western Union territory. Routes may be different, but all important points will be entered and connections maintained. This will involve considerable outlay, but the business will not be allowed to suffer. More up-to-date methods are being inaugurated, and it is confidently asserted that not a dollar will be lost in net earnings. The lines along the Pennsylvania Railroad are for the most part galvanized wire, or a light grade of copper wire, being thus far behind modern requirements. Along the Baltimore & Ohio, where the contract still has a long term of years to run, heavy copper wire is in general use. Lake Shore officials decline to make any comment on the Philadelphia report that the contract with Western Union will not be renewed. Vice-President Baker, of the Postal Telegraph, has specifically denied that there is any movement on foot looking to the installation of Postal lines on the Vanderbilt roads.

KEYSTONE TELEPHONE.—In interviews in Philadelphia, Keystone Telephone officers state that the company has more than fulfilled its promise to have 5,000 places installed with telephones before any charge is made. When the company began recently to earn an income, there were nearly 6,300 telephones in service, including Philadelphia, Camden and Gloucester. It is estimated that this number will yield about $300,000 gross receipts, the charge for an unlimited service being $80, and perhaps a third of the subscribers being on party wires. To pay the six per cent. dividend on $5,000,000 preferred stock requires $300,000, and the management estimates that double the present number of telephones in service will show net profits equal to the amount of the preferred dividend. About half or $2,500,000 of the preferred stock offered with the common stock bonus was taken on the original subscription and by the syndicate of organizers, and the fourth installment of $12.50 per share, making the stock full paid $50, matures next September. By that time, it is stated, the expenditures in constructing the plant will be represented by about that figure, and it will be then the purpose to go on and put up the balance of the $2,500,000 cash capital to complete the plant, which will then have a capacity for 30,000 telephones.

Commercial Intelligence.

THE WEEK IN TRADE.—The general trade conditions have been somewhat improved by the warmer and more settled weather, one encouraging feature being the discovery that the reports of the damage to crops by the recent rains were exaggerated. There is, however, hesitation still in some lines of distributive trade, due to the cool, backward weather, but the outlook is assuring. Among the industries, iron and steel still rank first in activity, the chief source of complaint being the scarcity of fuel, both coal and coke. There is some improvement noted in the labor situation. The railway earnings thus far reported for June, with the exception of the anthracite roads, show an aggregate gain of 8 per cent. over last year, and all reports as to probable crops and trade point to the maintenance of a heavy tonnage. Many furnaces in Pennsylvania have been shut down because of lack of fuel, and this reduces production, the full volume of which could be handled advantageously. Rails are in unprecedented demand, and 50 per cent. of the country's production for the next year has already been arranged for. There is also a lively demand for structural material, and it is stated that six months' production is easily on the order books. Hardware is in very active sale. The business failures for the week ending July 10, as reported by *Bradstreet's* aggregated 195 as against 138 the week previous and 199 the same week last year. The copper market was dull, the prices being in the buyer's favor. Closing quotations were 11.95@12.15c. for Lake, 11.95 11.05c. for electrolytic and 11.75@11.95 for casting stock—all for October delivery.

AMERICAN AUTOS IN ENGLAND.—A cable dispatch from London, of July 9, says: "The London Road Car Company, the second largest of the London street omnibus companies, has ordered ten Fischer electro-gasolene 'buses, to be built at Hoboken, N. J., at a cost of £500 sterling each. The new 'buses are to be delivered in three months. They will have a speed of 12 miles an hour and a capacity of 30 passengers, as against 26 passengers carried by the horse 'buses. The Fischer 'buses will travel 100 miles a day, as against 56 by the horse carriages. The cost of running each 'bus will be 2½ cents a mile." The automobile mentioned has been illustrated and described in these pages.

WESTINGHOUSE PRODUCER GAS EQUIPMENT FOR SPAIN.—The Westinghouse, Havre, France, which concern takes care of the Westinghouse interests (other than those of the Air Brake Company) in France, and some of the other countries in Continental Europe, has requisitioned, through Westinghouse, Church, Kerr & Company, for a 125-hp vertical producer gas engine for operating on Dawson gas for Juan Martinez, Linares, Spain.

THE ILLINOIS GLASS COMPANY has recently purchased an extensive electrical equipment from the Westinghouse Electric & Mfg. Co. This apparatus will be used for the operation of the machine, blacksmith and mold shops, blowers, etc., and includes a 250 k.w., two-phase, 440 volt, 60 cycle belted generator, twenty induction motors, thirty-eight transformers, and arc and incandescent lamps.

BROOKLYN BRIDGE MOVING SIDEWALK.—The New York Herald says that Cornelius Vanderbilt, Stuyvesant Fish, E. P. Ripley, Moses Taylor Pyne, S. S. Palmer and several other men prominent in the financial and railroad world are behind the scheme to put electric movable sidewalks on the bridge, and that the plan will be put in operation within a year.

SMITH & HEMENWAY CO., 296 Broadway, New York City, have bought out the entire business of Thomson Bros. & Co., manufacturers of the improved Seavey mitre box, the purchase including contracts, patents, good will, machinery, tools and plants; and will hereafter execute all orders for this device.

VALPARAISO, CHILE.—The municipality of the city of Valparaiso, Chile, invites tenders for the construction of an electric system and the supply of electric lighting. Bids will be received up to Sept. 1.

THE ELECTRICAL EQUIPMENT COMPANY, Chicago, has been awarded the contract for an addition to the Whiting (Ind.) Electric Light Company's plant.

SOME BUFFALO FORGE ORDERS.—The Buffalo Forge Company reports receipts, within the past few days, of a number of orders for induced draft plants, and engines for both foreign and domestic account. The American Trading Company has sent in an order for an induced draft plant for an electric light plant in Dutch Guiana. There will be a six-foot wheel, direct connected to a 6x6 inch vertical engine. O. B. Stillman, the sugar plant expert, of 80 William street, New York, has ordered five Buffalo engines for driving generators, etc., in the sugar factory to be built near Manzanillo, on the south side of Cuba, by the Cape Cruz Construction Company. Four of the engines are to be of vertical type, inclosed, for running in oil. Their dimensions are to be 10x12 inches. There will also be an 8x8 inch engine for operating pumping equipment. Domestic orders include one just secured from the Morse Iron Works of Fifty-eighth street, Brooklyn, for a 6x7 inch single vertical engine, to be direct connected to a Triumph generator. This outfit will be installed for electric lighting purposes on the oil steamer Patonia, now under construction for the Cuffy Oil Company. The Burnett Company has requisitioned, on behalf of the Consolidated Coal Company, Frostburg, Md., for a 6x6 inch vertical engine, to be direct connected to a 10 k.w. Sprague generator, for lighting use. The contracting firm of F. G. Blanchard, of 45 Willoughby street, Brooklyn, is to be furnished with a 9x16 x10 inch tandem compound engine, for direct connection to a 50 k.w. Fort Wayne generator. This equipment will be utilized for lighting purposes in the Ridgewood pumping station, Brooklyn. Mr. Blanchard has also ordered from the Buffalo people, for similar use, in the Millburn pumping station, Brooklyn, a 7x8 inch vertical engine, to be direct connected to a 17½ k.w. Fort Wayne generator.

MEAD CONVEYING MACHINERY ORDERS.—John A. Mead & Company, Bowling Green Building, has been awarded a contract for the supply of the necessary coal and ash conveying machinery to be installed in the Fisk street, South Chicago, station of the Commonwealth Electric Company. The Mead Company will in the first instance furnish a plant having a capacity of 75 tons per hour, to be run in connection with the first of the ten sections of the Babcock & Wilcox boiler equipment, which are to be ultimately installed on completion of the contract. The coal and ash conveying machinery will represent an expenditure of some $125,000. The Cleveland (O.) Electric Illuminating Company has ordered a Mead plant, to take care of 45 tons of material hourly. The Edison Electric Illuminating Company, Topeka, Kans., has also requisitioned for a coal and ash handling plant, having a capacity of 45 tons per hour. The Cincinnati (O.) Edison Company has sent a second order to the Mead people, which will increase the capacity of its existing coal and ash handling equipment from 45 tons to 90 tons per hour.

THE MOVEMENT IN COPPER.—Advices from Boston state that there is a belief in that city that the falling off in June exports of copper from the average of the previous five months marks the end of the abnormal outward movement of copper, which movement since Jan. 1 represented deliveries on old 11-cent contracts taken last December and early in January. The copper exports for June were but 12,500 tons, as compared with an average of 16,786 for the previous five months this year, a decline of 4,226 tons, or 25 per cent. Coupled with this falling off in exports is a production larger than ever before in the history of the industry. In conservative circles it is not believed that the home consumption of copper is sufficient to absorb without difficulty an increased production and the unshipped surplus. It is this situation which leads many copper people, including copper consumers, to move cautiously, believing that the statistical position of the metal favors lower rather than higher quotations.

INDIAN WATER POWER PLANT.—The British Indian house of Tata & Company, new Tontine Building, is desirous of securing data regarding water power plants, which their principal partner, Mr. J. N. Tata, of Bombay, one of the most influential and richest men in India, proposes to build, for the purpose of operating extensive iron and coal properties located in the Chanda district, Central Provinces. All the equipment will be of American manufacture and the expenditure will reach into the millions. Mr. Tata, who is now in London, will, according to present arrangement, arrive in the United States some time in September.

DE VEAU TELEPHONE APPARATUS.—The name of De Veau is well known in the telephone field, and there are many who will be interested to learn that Mr. A. S. De Veau, having severed his connection with Stanley & Patterson, is now devoting himself again exclusively to the manufacture of telephone apparatus. He has founded the De Veau Telephone Manufacturing Company, of which he is president, and has opened shops at 27 Rose street, where an up-to-date plant is producing telephone apparatus and material throughout the whole range. On August 15 he proposes to issue a complete catalogue.

THE JANDUS ELECTRIC COMPANY, of Cleveland, O., has been awarded the contract for furnishing 1,300 arc lamps for the complete equipment of the new store of R. H. Macy & Co., located on Herald Square, New York. This is one of the largest contracts, perhaps the largest, ever awarded for an isolated installation of arc lamps. The Jandus Company congratulates itself also that the contract, as made, calls for its most expensive lamps, viz.; the improved Jandus standard structure, which is more expensive than the ordinary lamp furnished by the company. Macy & Co. have used Jandus lamps for six or seven years past in their old store, and have evidently found them to be entirely satisfactory in service.

EQUIPMENT FOR BROOKLYN EDISON COMPANY.—The Brooklyn Edison Company's union station, at Sixty-sixth street, Brooklyn, is to be installed with a Buffalo force-draft plant, consisting of three steel-plate fans, with 10-foot wheels, each direct connected to a 10x12 inch Buffalo horizontal, centre-crank engine. The engines will be inclosed for running in oil. This outfit will take care of the 10.000-hp boiler equipment, which is being furnished by Thayer & Company, Incorporated, sales agents for the Cahall boilers, manufactured by the Aultman & Taylor Machinery Company.

SAULT STE. MARIE POWER.—In an official statement before the county board of supervisors, a representative of the Michigan Lake Superior Power Company, the Clergue syndicate, has stated that the company's plans includes the construction of many mammoth industries on this side of St. Mary's river. It was estimated that for this purpose 1,200 acres of land would be needed, and that the completion of the plants, practically all of which are to be operated by water power, would double the valuation of every acre of land in Chippewa county.

A LARGE TELEPHONE CONTRACT.—A competitive telephone test, over 400 miles of long-distance telephone lines, conducted by Wilbur H. Johnston, chief engineer of the Frontier Telephone Company, Buffalo, was recently held at Scranton, Pa. The result of this test was so satisfactory, it is stated, as to warrant the above company immediately placing an order with the Kellogg Switchboard & Supply Company for 6,000 telephones complete. The Kellogg transmitters have been tested on lines up to 1,500 miles, and found to be perfectly satisfactory.

POWER PLANT FOR COSTA RICA.—The Abangares Gold Fields Company, of Costa Rica, which concern, with Anglo-American capital, operates three mines in Central America, has placed contracts for the conversion of its present steam plant into a water-power plant. The initial electrical equipment will have a capacity of 300 hp, which, it is said, will be added to in the near future. The General Electric Company has been allotted the contract for the electrical apparatus. The Pelton Water Wheel Company has secured the water-wheel contract, as well as an order for 1½ miles of pipe.

WESTINGHOUSE ENGINES FOR AFRICAN COAL MINES.—The Indwe Coal & Land Company, of Cape Colony, South Africa, is to be furnished with two Westinghouse compound engines of 330-hp capacity, each for the purpose of driving an electric plant to work and light the company's extensive coal mines. The contract has just been awarded to Westinghouse, Church, Kerr & Company, by the South African commission house of Leaycraft & Company, 140 Pearl Street, N. Y.

LAWRENCE CENTRIFUGAL PUMP ORDERS.—The Lawrence Machine Company, 39-41 Cortlandt Street, N. Y., has secured a contract for a 4-inch centrifugal pump, to be direct connected to a Lawrence vertical engine for circulating purposes on a British man-of-war at Bermuda. The New Jersey Hot Water Heating Company, Atlantic City, has requisitioned for a 12-inch centrifugal pumping equipment of 7,000 gallons per minute, to be direct connected to a 150 h.-p. Lawrence vertical engine.

BALL ENGINE ORDERS.—The electric power plant of the new United States Steel Corporation, at Duluth, Minn., will consist of a 75-kw Westinghouse generator, direct connected to a tandem compound engine, built by the Ball Engine Co., Erie, Pa. An electric plant will soon be installed in the Deaf and Dumb Asylum, at Austin, Texas. The unit to consist of a Ball tandem compound engine, built by the Ball Engine Co., direct connected to a Westinghouse 90-kw alternator.

HOTEL TELEPHONE SERVICE.—The new St. Regis, Fifth avenue and Fifty-fifth street, and the Marie Antoinette, have been added to the list of New York hotels having long distance telephone service in every room. Contracts have been signed for 350 stations at the St. Regis and for 300 stations at the Marie Antoinette.

General News.

THE TELEPHONE.

WILMINGTON, DEL.—The American Telephone and Telegraph Company has been incorporated with a capital of $300,000. Incorporators: Josiah Marvel, Andrew Marvel and Ralph C. Lupton, all of Wilmington, Del.

WILMINGTON, DEL.—The Western Telephone and Telegraph Company, Wilmington, Del., has been incorporated; capital $500,000. Incorporators: Josiah Marvel, Andrew Marvel and Ralph C. Lupton, all of Wilmington, Del.

AUGUSTA, GA.—The Bell Telephone Company has decided to install entirely new equipment. A modern supervisory common-battery switchboard will be installed.

AUGUSTA, GA.—Another step in the telephone war in Augusta is a petition of the Bell Company to be permitted at once to place its wires underground. An ordinance was passed some time ago requiring that all wires be placed underground within ten years.

MASON CITY, ILL.—A rural mutual telephone company will be organized in this place.

FLANAGAN, ILL.—The Flanagan & Dana Telephone Company, which was incorporated last March, is using Stromberg-Carlson and American Electric apparatus. The exchange was started in July last year and has 50 subscribers.

ATWOOD, ILL.—The Atwood Mutual Telephone Company, which was incorporated last April, is using Stromberg-Carlson apparatus. The shares are $40 apiece, each shareholder contributing 20 cents per month for the maintainence of the exchange.

WINCHESTER, IND.—The Eastern Indiana Telephone Company has increased its capital stock from $5,000 to $15,000. Many improvements will be made to take care of increasing business.

RISING SUN, IND.—The Ohio River Telephone Company is operating exchanges at Vevay and Rising Sun, the total number of subscribers being 325. The company is also operating 150 miles of toll lines. Both exchanges are full metallic. The company now contemplates building some new lines. It has 100 new subscribers waiting for connection.

ELDON, IA.—The Eldon Independent Telephone Company has been incorporated with a capital stock of $25,000.

MITCHELLVILLE, IA.—The Mitchellville Telephone Company, capital stock $10,000, has been incorporated by J. B. Uhl, B. R. Patterson and S. J. Oldfield.

MAYKING, KY.—Citizens of Cornettsville have organized a telephone company to build a line to Hazard.

FRANKFORT, KY.—The Cynthiana Telephone Company has increased its capital stock from $30,000 to $40,000.

NICHOLASVILLE, KY.—The Jasamine County Home Telephone Company has been formed with a capital stock of $50,000.

LEXINGTON, KY.—Desha Breckenridge, president of the Lexington Home Telephone Company, is interested in two new independent companies proposing to build exchanges at Paris and Nicholasville, Ky. The companies were incorporated under Delaware laws by Kentucky capitalists.

BOYDS, MD.—The Boyds Telephone Company has been merged with a new company to be known as the Cumberland Valley Telephone Company. The merger with the Maryland Telephone Company, of Baltimore, the Westminster Company and the Western Maryland is now complete.

HARRISONVILLE, MO.—The Cass County Telephone Company, of Harrisonville, has increased its capital stock from $2,000 to $20,000.

MEXICO, MO.—R. V. Montague and other gentlemen from Kansas City have purchased the Mexico Telephone system and are going to extend the lines throughout this section of the state. It is said that $10,000 will be spent in improvements.

BEATRICE, NEB.—The Nebraska Telephone Company has planned to build a new exchange which will cost about $6,000.

CAZENOVIA, N. Y.—The Cazenovia Telephone Company has been incorporated with $1,000 capital. Directors: H. Burden, Jr., J. A. Boyster and M. R. Joy.

WILMINGTON, N. C.—The Southern Bell Telephone Company will lease a handsome new building, soon to be erected, as an exchange. Fifty thousand dollars will be expended in rebuilding the local exchange. The long distance line has been completed for a distance of fifty miles.

MANDAN, N. D.—The Mandan Telephone Company, wich was organized early this year, is building 40 miles of new line. It is using Eureka apparatus, the switchboard having a capacity of 200 drops.

ANTWERP, OHIO.—The Antwerp Telephone Company has increased its capital stock from $10,000 to $20,000.

GALION, OHIO.—The Galion Telephone Company is making many improvements. The company has orders for over 70 new telephones.

LA RUE, OHIO.—The Marion County Telephone Company has brought suit in the probate court to compel the council of La Rue to grant it a franchise.

BOWLING GREEN, OHIO.—The Bowling Green Telephone Company has announced a flat rate of 10 cents for all toll business throughout the entire county.

CHILLICOTHE, OHIO.—The Chillicothe Home Telephone Company has converted $50,000 of its common stock to preferred stock. The company is making improvements.

CINCINNATI, OHIO.—The City & Suburban Telephone Association is preparing to erect a branch exchange at Cummersville. The switchboard will have a capacity of 15,000 lines.

TOLEDO, OHIO.—The Central Union Telephone Company has secured permission to extend its underground district throughout a considerable portion of the business section of the city.

NEWARK, OHIO.—The Newark Home Telephone Company is making preparations to rebuild its entire system and install first-class central energy equipment. Plans for the system are being prepared.

BERGHOLTZ, OHIO.—The Bergholtz Telephone Company has been incorporated with $5,000 capital stock by Lewis Steinmetz, J. W. Carlson, A. G. McBane, James McBane and W. E. Steinmetz.

CHARDON, OHIO.—The Chardon Telephone Company has increased its capital stock from $10,000 to $25,000 to provide for improvements. Orange Pomeroy is president and W. C. Parsons, secretary.

MANCHESTER, OHIO.—The Manchester Telephone Company is preparing to build several miles of farmers' lines on both sides of the Ohio River. Mr. R. C. Henderson is secretary and treasurer of the company.

TROY, OHIO.—The Troy Telephone Company is enjoying prosperous business. About fifty instruments were placed during June and an equal number during both April and May. The company's list is now close to the thousand mark.

MONTPELIER, OHIO.—The Montpelier Telephone Company has purchased from the Williams County Toll Line Company a line from Angier to Bocks Corners. This gives the home company direct connection with Angier and Bridgewater.

CLEVELAND, OHIO.—The directors of the United States Telephone Company have voted favorably on the proposition to increase the company's capital stock by an issue of preferred stock. The additional stock will be subscribed for by the various independent companies identified with the United States Company.

MARION, OHIO.—The Marion County Telephone Co. has completed arrangements with the Morrow County Telephone Company and the Logan County Telephone Company whereby both systems will be connected with the Marion County system. The Marion company is making rapid progress and expects to commence business in the near future with 1,000 subscribers.

WAKEMAN, OHIO.—The Wakeman Mutual Telephone Company has sold out to the Local Telephone Company of Norwalk. The latter company is headed by F. J. Lanning, who has been buying up a number of independent properties in northern Ohio. The system will be improved and long distance connection afforded through the lines of the United States Telephone Company.

HAMILTON, OHIO.—The Hamilton Home Telephone Company has placed a contract with the Northern Construction Company for the construction of its new exchange. The company will start with about 750 telephones, contracts for almost that number having already been closed. Rates are $2.50 for business, $1.50 for residence and from $1 to $1.50 per month for farmers' lines.

PORTSMOUTH, OHIO.—Judge James M. Thomas, of Cleveland, has purchased practically all of the stock of the Portsmouth Home Telephone Company, heretofore controlled by the Federal Telephone Company. He was in Portsmouth recently to arrange to reorganize the company on local lines; local people to take a large portion of the stock. If the deal is effected, it is the intention to make many necessary improvements and to extend the toll lines throughout the surrounding country.

NORWALK, OHIO.—The stock of the Huron County Telephone Company and the Attica Telephone Company has been transferred to the new Local Telephone Company which was formed a short time ago to absorb a number of exchanges in this section. The new company is now one of the largest in the independent field. It owns exchanges at Norwalk, Milan, Berlin Heights, New London, Monroeville, Chicago Junction, Plymouth, Attica, Galion and other towns, besides many miles of toll line.

CLEVELAND, OHIO.—The May statement of the United States Long Distance Telephone Company shows gross earnings $24,291, operating expenses $12,849, net earnings $11,643, interest $7,771, surplus $3,872. For the same month in 1901 the figures were $11,926, $7,287, $4,639, $4,166 and $472 respectively. It is figured that on the above basis the company will have a surplus this year of over $30,000 after paying all fixed charges and the interest on $200,000 preferred stock which it is proposed to issue.

CHARLESTON, S. C.—The council has voted that the Bell Telephone Company shall place all wires underground.

LANCASTER, S. C.—The Lancaster Telephone Company, capitalized at $5,000, has been formed. W. B. Moore is president and J. T. Thomasson vice-president.

GREENVILLE, S. C.—The Home Telephone Company, has been sold out to L. W. Floyd, of Newberry, for $10,200. The plant was sold to satisfy a mortgage of $30,000.

KERSHAW, S. C.—The Kershaw Telephone Company, capital $5,000, has been incorporated. W. B. Moore is president, S. W. Heat, vice-president, and J. T. Stevens, secretary and treasurer.

COLUMBIA, S. C.—L. W. Floyd, of Newberry, by recent purchases now owns exchanges in fifteen towns and cities of the State. Mr. Floyd intends soon to connect all these exchanges together and also with Columbia.

COLUMBIA, S. C.—The Blacksburg Telephone Company, capital $3,000, the Bedford Telephone Company of Yorkville, S. C., capital $5,000, and the Lancaster Telephone Company, capital $5,000, have been chartered. W. B. Moore is interested in each of these enterprises.

McMINNVILLE, TENN.—The Warren County Telephone Company has been incorporated; capital stock, $12,500. Incorporators: W. S. Ross, J. C. Biles, J. B. Biles and others.

NASHVILLE, TENN.—The Cumberland Telephone and Telegraph Company will establish a large cresote plant in Nashville to treat its poles, on account of scarcity of cedar poles.

EUREKA, TEX.—The Eureka Telephone Company has been incorporated; capital stock, $4,000. Incorporators: J. A. Bonner, J. R. McCormick, R. Goree and others.

PAMPLIN CITY, VA.—Telephone communication has been established with Madisonville. The line will be completed to Red House.

CLOVERMONT, VA.—The Clovermont Telephone Company has been chartered to build a line to Surry Court House, Waverly and Petersburg, capital $1,000 to $5,000. Geo. H. Woods is president.

ELECTRIC LIGHT AND POWER.

SAN FRANCISCO, CALIF.—The Standard Electric Company, of California, has made a survey of a new eight-mile power line from the Electra power station to Sutter Creek. The plant has been operating with scarcely any interruption for some weeks to within a few miles of San Francisco. The San Francisco sub-station will probably be started up within two weeks. The Pacific Power Company's underground system will be used for distribution, but will have to be reconstructed. Three storage batteries will be installed in San Francisco.

CRIPPLE CREEK, COL., has granted two franchises to electric companies; the Colorado Electric Power Company and the People's Electric Light Company. These two companies have agreed to pay 2 per cent. of their gross receipts into the city treasury.

DENVER, COL.—J. R. De Remer, of Glenwood Springs, Col., has taken up water rights at Shoshone Falls. It is estimated that 20,000 horse power can be derived from the fall of 850 cubic feet of water per second. The new company when formed, will furnish electric light and power for all towns between Red Cliff and Grand Junction. Mr. De Remer has associated with him C. W. Darrow, B. T. Napier, T. E. Ryan and H. J. Holmes.

McRAE, GA.—An election has been carried for bonding the town for water and electric lights.

HARTWELL, GA.—The town will erect water and electric lighting plants. It is probable that municipal bonds will be issued.

ATWOOD, ILL.—A domestic electric lighting plant in this town would no doubt prove to be a paying investment, and an electric railway would also prove equally profitable.

RISING SUN, IND.—There is no electric light plant in this place, which seems to offer a good field for such an enterprise.

BOONVILLE, IND.—A suit has been brought to set aside a franchise and contract for fifty years granted to the Boonville Electric Light & Power Company. A franchise has been granted to a new light and heat company and it will furnish cheaper light.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company, of this city, has incorporated with $150,000 capital stock. F. M. Ayers heads the board of directors. The franchise offered by the board of public works provides for a rate of 10 cents per kilowatt for incandescent electric lighting.

HARTFORD CITY, IND.—The city council has repealed the franchise of the Hartford City Lighting Company. The city has also repudiated the proposition to sell the plant to the city. The council now threatens to remove the company's poles and wires from the streets. As yet the company has not made a move in the matter, but it is understood that it will attempt to hold the city to the contract for 120 lights at the rate of $80 per light per year for ten years. Citizens have subscribed a fund to pay for litigation in the matter.

BURNSIDE, KY.—The Burnside Electric Light & Power Company is in the market for supplies, including wire and fixtures. This company operates two Bullock direct-current generators and has a small power load. Mr. R. McCracken is treasurer and general manager.

DIAMOND, LA.—A new electric light plant for the inspection of ships has been completed by the Safety Electric Company and delivered to Dr. Thomas.

DETROIT, MICH.—The Detroit United Railway has offered to lease its poles to the city for lighting purposes at the rate of $1 each per year.

ST. LOUIS, MO.—The first carload of porcelain electrical appliances shipped to the World's Fair site by the Commercial Electrical Supply Company arrived July 7. This is the first of eleven carloads which will be needed to equip the lighting lines of the Exposition. Chief Electrical Engineer Rustin states that 1,492,250 wiring knobs will be required.

ALBEMARLE, N. M.—The Gold Road mine at Albemarle will build a large power plant to furnish power to its own mine and others.

PLATTE, N. D.—An electric light plant in this place would fill a want, as there is none here.

MANCHESTER, OHIO.—There is an opening in this town for an electric light plant.

NEW LONDON, OHIO.—Citizens have voted to issue $2,000 bonds to improve the lighting plant.

DELAWARE, OHIO.—The Delaware Gas Company has amended its charter to enable it to furnish electricity as well as gas. It is the intention to install an electrical plant.

HUBBARD, OHIO.—The electric light committee of the council has been instructed to proceed with the work of rebuilding the lighting plant which was destroyed by fire some time ago.

NORTH AMHERST, OHIO.—The village council is procuring estimates as to the cost of a municipal lighting plant and the work of constructing the same will commence as soon as possible.

BOWLING GREEN, OHIO.—The county commissioners have passed a resolution deciding to build a lighting plant in this place, with sufficient capacity to heat and light all the county buildings.

NEW BREMEN, OHIO.—The village council has called an election to decide on the question of issuing bonds to the amount of $50,000 for a municipal lighting and water works plant.

COLUMBUS, OHIO.—Bids will be advertised for improvements to the electric lighting and heating systems at the state institution for the blind. Stribling & Lum, architects, have prepared plans.

SANDUSKY, OHIO.—The plant of the Sandusky Electric Light Company was damaged by lightning a few days ago. The town was dark for several days and a number of manufacturing establishments using electric power were tied up.

CLEVELAND, OHIO.—A company headed by B. P. Foster has applied to the council for a franchise to lay pipes for supplying hot water, heat and electricity for power purposes. The promoter claims the company will furnish electricity much cheaper than the existing company.

EL RENO, OKLA.—The El Reno Light and Power Company was organized January last and purchased the old plant, which is being entirely rebuilt on new lines. Two Bullock two-phase, 60-cycle alternators constitute the new generating equipment. The new system is modern throughout, and it is thought by the managers that this plant is a model one. Mr. Henry Larsen is president, J. A. Masters secretary and manager, and C. M. Jackman, treasurer.

YORK, PA.—An ordinance will be presented to the councils of this city recommending the installation of a new city electric light and power plant. After consideration several of the councilmen have come to the conclusion that it would be cheaper for the city to own a plant than to pay rent at the rate of $24,000 per annum for street lighting alone. A "careful estimate" by some of the councilmen, it is stated, shows that a new plant could be installed at a cost not to exceed $50,000.

CAMDEN, S. C.—The Carbon Light and Power Company, chartered in New Jersey with $40,000 stock, has applied for permission to do business in South Carolina with headquarters at Camden.

SALT LAKE CITY, UTAH.—The Salt Lake office of the General Electric Company has closed a contract with an Idaho Falls corporation for a lighting plant of 2,000 incandescent lamps capacity, including a 100-kw power generator.

OTTAWA, ONT.—The Trenton Electric Company, of Trenton, Ont., will develop 600 additional horse power and will build a second transmission line to Belleville, Ont.

OTTAWA, ONT.—The town council of Cookshire, Que., has decided to purchase the water power on the St. Francis river and to establish an electric light and power plant. The town council of Sherbrooke, Que., also contemplates the purchase of a water power with a view to establishing an electric light system of its own.

OTTAWA, ONT.—The extensive works of the Ottawa & Hull Power Company, in Hull, Que., which have been in progress for the past eighteen months, are expected to be completed within the next three months. When the present work is finished, the company will be in a position to furnish 12,500 hp of electric energy. The company will, in time, further develop its property to about 35,000 hp. Over half a million dollars have already been expended on the works, which will cost upwards of $1,000,000 before final completion. Over 240,000 cubic feet of solid rock have been excavated for the reservoir. The dynamos will be direct-connected to the turbines. Five dynamos of 2,500-hp each will be installed.

THE ELECTRIC RAILWAY.

BIRMINGHAM, ALA.—The directors of the Birmingham Railway, Light and Power Company have declared a semi-annual dividend of three per cent. on the preferred stock.

JACKSONVILLE, FLA.—The street railway interests of Jacksonville have passed into the hands of Stone and Webster, of Boston, who already control a number of similar holdings in the South. It is stated that the new owners expect to spend $150,000 in the next twelve or sixteen months improving the Jacksonville lines and terminals.

MACON, GA.—It is reported that the Railway and Light Company of America is negotiating for the power plants of Macon. J. W. Middendorf, of Baltimore, is president of the company proposing to purchase.

WEBSTER, MASS.—Dispatches from Webster, Mass., state that four street railways, aggregating sixty miles, are to be consolidated as the Worcester and Connecticut Eastern Railway, controlled by New York parties.

DETROIT, MICH.—The Detroit United Railway is now operating a special observation car which makes a two-hour trip over the city and suburban lines. A well-informed attendant accompanies the car for the purpose of pointing out places of interest. The fare for the trip is 25 cents.

MERIDIAN, MISS.—The Meridian Light and Railway Company has increased its capital stock to $450,000.

JAMESTOWN, N. Y.—The Warren and Jamestown Electric Railway Company has filed papers of incorporation with the Clerk of Chautauqua County. The company is capitalized at $100,000, and will build an electric railway from Warren, Pa., to Jamestown.

YOUNGSTOWN, OHIO.—The Mahoning Valley Railway Company has applied for a franchise to make some extensions in town.

CANAL DOVER, OHIO.—The council has granted a franchise to the Akron-Canton Railway Company for its extension to New Philadelphia.

FREMONT, OHIO.—A. H. Jackson, a wealthy manufacturer of this city, is at the head of a new project to build a line from Fremont to Sandusky.

YOUNGSTOWN, OHIO.—The Pennsylvania & Mahoning Valley Railway Company has voluntarily increased the wages of motormen and conductors on several divisions.

YOUNGSTOWN, OHIO.—It is announced that the Youngstown-Sharon Railway & Light Company is earning at the rate of $100,000 a year compared with $79,000 last year.

YOUNGSTOWN, OHIO.—The Pennslyvania & Mahoning Valley Railway Company will probably build a new line from Youngstown along the south side of the river to Struthers.

MARIETTA, OHIO.—The power house and car barns of the Parkersburg & Interurban Street Railway Company were badly damaged by a tornado a few days ago. Several cars in the car house were demolished.

KINSMAN, OHIO.—Citizens of Orangeville, Gustavus and Kinsman are raising a fund to secure an extension of the Eastern Ohio Traction Company's road through these points. The road now extends to Chardon and Garrettsville.

CLEVELAND, OHIO.—As the result of lightning the power house of the Cleveland, Painesville & Eastern Railway, at Willoughby, was disabled for several days recently. One of the large generators burned and an engine was disabled.

YOUNGSTOWN, OHIO.—The Youngstown & Southern Railway Company has been organized by A. W. Jones, J. H. Ruhlman and W. S. Andrews, of Youngstown, and R. L. Andrews, of Cleveland. The road will be 38 miles long, extending from Youngstown to East Liverpool.

CLEVELAND, OHIO.—The Pomeroy-Mandelbaum syndicate has decided to push to completion the Cleveland & Southern Railway which is now in operation from Cleveland to Medina. As soon as possible it will be extended to Chippewa Lake and then to Seville, a distance of ten miles from Medina.

COLUMBUS, OHIO.—The Columbus, Newark & Zanesville Electric Railway Company has been incorporated with $1,500,000 capital stock by J. R. Harrigan, A. C. Ralph, C. A. Alderman, H. A. Fisher and J. A. Godown. The company proposes to build a road from Newark to Zanesville.

NORWALK, OHIO.—The city council has declared forfeited the franchise granted some time ago to the Sandusky, Monroeville, Bellevue & Norwalk Railway and has ordered the company to remove its property from the street and repair the street. The road has been partially completed but inactive for many months.

CLEVELAND, OHIO.—The two Cleveland street railway companies have agreed to permit a committee appointed by the United Trades and Labor Council to inspect their books and ascertain exactly what it costs to operate the road and carry a passenger. The railway officinls claim this is the first time they have ever been approached by a non-partisan committee looking for facts.

YOUNGSTOWN, OHIO.—At the annual meeting of the Youngstown, Park & Falls Electric Railway Company officers were chosen as follows: C. S. Grier, president; Joseph Hastings, vice-president; C. W. Dahlinger, secretary-treasurer. Samuel C. Grier, Joseph Hastings, J. R. Murphy, Robert McAfee, of Allegheny, C. W. Dahlinger, of Pittsburg, and Harry G. Hamilton and W. H. Park, of Youngstown, are directors. The semi-annual dividend of three per cent. was declared.

NEW INDUSTRIAL COMPANIES.

THE NEW ENGLAND ELECTRIC MUSIC CO., of Jersey City, has been incorporated; capital, $200,000. Incorporators: Ernest P. Hoes, Wm. M. Fischer and K. K. McLaren.

G. B. W. ELECTRIC SPECIALTY CO. has been formed in New York by Josef Veit and C. F. Lewis, of New York City, and L. C. Scrymser, of Brooklyn, with a capital stock of $15,000.

J. D. JEWETT CO. has been formed at Boston, Mass., with $30,000 capital, to succeed J. D. Jewett & Co. In the new concern Mr. J. D. Jewett is president and Howard E. Whiting treasurer.

THE DE VEAU TELEPHONE MANUFACTURING COMPANY, of New York, has been incorporated; capital, $50,000. Directors: A. S. De Veau, William Hoffman, New York; Charles Auth, Brooklyn.

THE ELECTRIC METAL SEPARATING COMPANY of Paterson N. J. has been incorporated to refine scrap metals, etc.; capital, $150,000. Incorporators: Samuel Boehm, Wm. Jacobus and John Unger.

THE KENTON CONSTRUCTION COMPANY, Kenton, O., capitalized at $10,000, has been organized by J. Timmons, J. W. Fulton, J. B. Seymour, James Bastable, F. D. Bain and others, to construct telephone plants.

THE DIAMOND ELECTRIC MACHINERY COMPANY, of St. Louis, has been incorporated with a capital stock of $12,000. The incorporators are: Charles Lindenberger, Harry Lindenberger, Houston Jones, Alexander M. Dannold and others.

QUINCY ELECTRIC DRILL CO. has been formed under the laws of New Jersey to make electric drills, with a capital of $500,000. The incorporators are G. F. Bradstreet, of Boston; R. M. Farries, of Jersey City, and H. L. Keyes, of Hackensack, N. J.

THE LENOIR ELECTRIC COMPANY, Lenoir, N. C., has been chartered, with a capital of $50,000, to deal in electrical machinery, construct telephone lines, power plants, etc. G. L. Benhardt, G. W. F. Harper and L. M. Parks are the incorporators.

LEGAL.

AUTOMATIC LUBRICATION.—The Circuit Court of the United States for the Western Division of the Eastern Circuit of Missouri handed down an opinion June 21 in a suit for the infringement of a patent granted April 4, 1899, to Chas. R. Meston for an improvement in lubricated bearings, designed specially for use in connection with electric ceiling fan motors. The court defines the essential features of the invention as follows: The method of operation is to supply a lower oil cup, which is integral with the hub, with oil sufficient to submerge the lower bearings of the hub and the lower end of a spiral groove, which forms a continuous channel in the armature bearing around the shaft from the lower or central portion of the oil cup, extending upwardly to the reservoir at the top of the hub. When the fan is put in motion the oil is forced by the centrifugal action of the rotary cup, up the channel on the principle of an archimedean screw, lubricating the shaft as it enters, and any superfluity finds its way into the upper reservoir. When the fan is stopped the oil by gravity falls back through the channel into the lower oil cup ready for repeated service when the fan is again started. To avoid friction the lower end of the revolving head rests upon a ball bearing consisting of a series of hardened steel balls, which travel or rest upon an annular shaped track placed in the bottom of the oil cup. The contention of the defendent was that Meston was not the original and first inventor of the device. The opinion states that though it be conceded that the elements were all old, this is of no consequence provided the application as found in the claims is new and original and produces a new and useful result. After discussing in detail all the points brought forward by the defendant and analyzing the testimony given, the court decides that each of the four claims in suit covering the invention are valid, and a decree was ordered to be entered for the complainant.

OBITUARY.

MR. F. B. THOMAS.—We regret to note the death of Mr. Frank B. Thomas, assistant manager of the Waldorf-Astoria Hotel, from typhoid fever, at his summer home, Bensonhurst, Long Island. He was only 33 years of age, and leaves a widow and two children. Mr. Thomas was known to a large number of electrical people and was interested in one or two electrical enterprises.

PERSONAL.

MR. FRANK J. GOULD will, it is reported, spend $2,000,000 in improvements on the trolley system of Richmond, Va.

PRESIDENT HOOD, of the Western Maryland Railroad Company, has been made president of the United Electric Light & Power Company of Baltimore.

MR. M. D. MAZENET, managing director of the Mexican General Electric Company is now on a visit to the United States. He will be in this country for about three weeks.

COL. R. G. MONROE, a well known leader in political reform movements in New York, has succeeded Mr. J. H. Dougherty as Commissioner of Water Supply, Gas and Electricity.

MR. EDMUND R. CROSS, of the Westinghouse Electric & Manufacturing Company, has just returned to Pittsburg after a vacation trip to his home in Huntington, Mass., and to Boston.

MR. L. B. SHEPHERD, of the City of Mexico and Monterey, it is reported, will build a power plant at Montemorelos. An electric traction system, 23 miles in length, is also proposed.

MR. EUGENE HOLCOMB, formerly lessee and general manager of the Capital Electric Company, sailed for London on July 4 on his way to Buenos Ayres. He will represent Westinghouse interests in the Argentine Republic.

MR. WM. STANLEY, JR., went abroad immediately after the Great Barrington meeting of the American Institute of Electrical Engineers, in which he took so prominent and active a part. He is said to be now on the Continent.

MR. C. J. H. WOODBURY has a very interesting article on "The Telephone System" in the *Lynn Business Magazine* for June, in which he discusses the invention, the apparatus, the operation and miscellaneous applications of the telephone.

MR. R. PFUND, electrical engineer, has arrived on the Pacific Coast to install a wireless telegraph system for the U. S. Signal Service in Alaska, between Fort Gibbons on the Yukon River and Bates Rapids Fort, on the Tanaua River, a distance of 195 miles.

MR. RUDYARD KIPLING.—The latest thing in science always interests Rudyard Kipling. His new story in the Fiction Number of *Scribner's* for August, has for its setting a house on the coast of England where Marconi experiments are taking place on a cold winter night, and they are listening to the battleships of England talking back and forth through the air along the Channel.

BINGHAM-STEVENS.—Mr. W. Briston Bingham, of the direct-current engineering department of the General Electric Company, was recently married in Schenectady, N. Y., to Miss Bertha A. Stevens of that city. Mr. Bingham is a '98 graduate of the Worcester Polytechnic Institute and has been ever since identified with the General Electric Company in the testing, drafting and engineering departments. Mr. and Mrs. Bingham returned, June 30, from a trip to Provincetown and Boston, where they renewed acquaintance with friends.

MARTIN-KANE. The wedding occurred at Bluehill, Ellsworth, Me., of Miss Lillian May Kane, daughter of Capt. John W. Kane, to Mr. Fred L. Martin, formerly of Hancock Point, but now in charge of the publication bureaus of the Kellogg Switchboard & Supply Co., of Chicago. The church was filled with guests and friends, and the ushers were six young women, companions of the bride. A large number of handsome presents were given to the happy pair, who have since been spending their honeymoon in Maine before returning to Chicago to make their home in that city. Mr. Martin has been doing excellent work in the West, and some of the booklets and pamphlets prepared by him are very valuable and interesting.

MR. T. J. LEE, the general passenger agent for the Lackawanna Railroad, is a firm believer in the telephone for railroad purposes, and he says: "It will not be very long before we will have a telephone at about every place we now have the telegraph. It will take time, of course, to get the entire system up to that stage, but it's coming. The Lackawanna recently established a tourists' bureau and I think that telephone scheme is about the whole thing in it. As for the time tables and the circulars and telling when the 8 o'clock train leaves, why, that part's easy; they all can have that kind. But the way I've got it fixed is immensely better. In comes a fellow and says he's going to the Pdq House for a week with his family. 'How much is the board there?' he asks. He is told and also the other usual small things he wants to know. And then in comes the telephone. Our friend says when he's going and the hotel proprietor is told at just what train to have his team to meet him. And the arrangements for room reservation are also made. It's great; everything is fixed before he starts."

Trade Notes.

SECOND-HAND MACHINE TOOLS.—List No. 25 of second-hand machine tools has just been issued by the Garvin Machine Company, New York. The list covers 12 closely printed pages and includes about everything coming under the head of this general subject.

THE WELLMAN-SEAVER-MORGAN ENGINEERING COMPANY, of Cleveland, is developing plans to erect two more foundries in addition to the large foundry building nearly completed. The company will also build a large office building adjoining the new plant.

THE LIBBY GLASS COMPANY, of Toledo, Ohio, is erecting two additions to its plant; also two new furnaces. The manufacture of electric light bulbs is becoming a very important feature of this company's business and the new plant will be used largely for this work.

CROSS OIL FILTERS.—The Burt Manufacturing Company, of Akron, Ohio, announces that it has just furnished two very large Cross oil filters to the U. S. Steel Corporation for its works at Youngstown, Ohio, making 108 of these filters now in use by this company.

STORAGE BATTERY LOCOMOTIVES.—The C. W. Hunt Company, West New Brighton, Staten Island, New York, is sending out a card containing illustrations of its storage battery electric locomotives and some text matter pointing out the principal features of these machines.

THE YOST-MILLER COMPANY, Toledo, Ohio, now capitalized at $40,000, will increase its capital stock to $75,000. Among other articles the company manufactures incandescent lamp sockets and at present it has orders on hand for over 100,000 of them, necessitating an increase of facilities.

THE NEW EAST RIVER BRIDGE, between Manhattan and Brooklyn Boroughs, has its wires and cables coated with a mixture of Acheson graphite and slushing oil as a thorough preventive against rust and corrosion. There are four cables containing all told 30,784 wires, weighing 5,000 tons.

THE E. G. BERNARD CO., of Troy, N. Y., has been awarded the contract, at $6,000, for installing a lighting and power plant in the United States government armory at Springfield, Mass. Though the Troy company was not the lowest bidder, it received the contract through the fact that it successfully installed a $30,000 plant in the Watervliet arsenal.

FOUNTAIN MFG. CO. has removed its general offices and salesroom from 97 Bank Street, New York City, to 15 Cortlandt Street, where all communications should be addressed. It will retain as its stock room its present Bank Street quarters, where it will carry a complete supply of junction, outlet and panel board boxes for the benefit of the local trade.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is taking particular pride just now in its "multiple burning" sign lamp. This is very effective for advertising and decorative purposes, and is unsurpassed in window displays. This lamp is being sold quite extensively at present for sign work in connection with street fairs and expositions. As it is a product of the Packard factory it goes without question that it is just the thing for the purpose.

RENOLD SILENT CHAIN is the subject of a very dainty little pamphlet just issued by the Link-Belt Engineering Company, of Nicetown, Philadelphia. It is devoted to an illustrated description of the Reynold silent chain gear which has been brought out of late with so much eclat, and of whose good work there is abundant report. Several applications are shown. Due notice of this chain has been made already in these columns, as its eminent applicability to dynamo and motor drive is obvious.

PUMPING MACHINERY.—The Stilwell-Bierce & Smith-Vaile Company Dayton, Ohio, has just brought out a very complete catalogue of its pumping machinery. The catalogue contains 176 pages and is illustrated with views of general types of pumps. The illustrations are all half-tone and executed in a very artistic manner. Many of the pumps shown are electrically driven by single reduction gear. In addition to the trade features of the catalogue there is some useful engineering information.

THE TESLA LABORATORY.—The pipes in the plant of the Tesla Laboratory, Warden Clyffe, Long Island, N. Y., were recently covered by the H. W. Johns-Manville Company. Mr. Tesla writes: "I have watched this work with interest and am well satisfied with the manner in which it has been done." The covering used in this instance is the well known Asbestos-Sponge felted sectional pipe covering constructed of fibres of asbestos and a small quantity of granulated sponge, the result being an excellent insulator.

THE STANDARD VITRIFIED CONDUIT CO. is the name of a new concern recently formed to handle vitrified salt-glazed underground conduits and insulators, with general offices at 39 Cortlandt St., New York. Mr. R. W. Lyle is president and manager and Mr. B. S. Barnard, vice-president and secretary. Both of these gentlemen were formerly with the American Vitrified Conduit Co. Mr. Barnard, whose friends are legion and without whom an electrical convention would be without its most scintillant light, will attend to the sales end of the business.

THE STERLING ELECTRIC MANUFACTURING COMPANY, Warren, Ohio, has broken ground for a new building which will be as large as its present establishment. When it is completed it is stated the company will have a capacity of 10,000 lamps per day. The company is going to considerable trouble and expense to educate its employees and make them more efficient. A class has been organized which meets regularly and a thorough electrical course, in charge of a competent teacher, has been mapped out for employees who care to make an endeavor to advance.

SWITCHES.—S. K. C. Bulletin No. 127, headed "Switches," 32 pages, of the Stanley Electric Manufacturing Company, is ready for distribution. Besides the well-known type of S. K. C. slide switches, carbon break switches, etc., many specialties are included, among which are a combined oil switch and circuit breaker for great capacities at high voltage and a line of knife switches, the blades of which are made up of units, providing a range in capacity from 50 to 3,000 amperes, single or double throw, with or without fuses and with or without quick break.

DIRECT-CONNECTED GENERATORS.—The Fort Wayne Electric Works, Fort Wayne, Ind., in Bulletin No. 1024, describe and illustrate their type M. R. L. 10—400—120 direct-current generator with vertical split frame. These machines are designed for supplying power and lighting circuits, not only in large central stations, but also in small isolated plants where space is valuable. Special attention is called to the brush holder. The carbon brushes are held in radial position in one long narrow brass box so arranged that the pressure of any brush on the commutator can be adjusted without in any way disturbing the other brushes or changing their adjustment. The illustrations show very clearly the construction of the generator. Diagrams and accompanying tables give the general dimensions of the machines.

WESTINGHOUSE, CHURCH, KERR & COMPANY announce the removal of their Pittsburg office from its former location on the first floor of the Westinghouse Building to more commodious quarters on the eighth floor of the same building. This change is the direct outcome of largely increased business in this district, and is accompanied by the acquirement of a commodious reception room devoted exclusively to the convenience and entertainment of visitors and patrons. The object of the management in making the change is to be able to accommodate more thoroughly and promptly the wishes and needs of their patrons. They are prepared to give immediate attention to all classes of general engineering and construction work as applied to power and its uses in transportation and industry. They will provide in all cases from their engineering force adequate personal supervision of work in hand, both during construction and subsequent thereto, and the increased facilities afforded by their new quarters will enable them to fulfill the most extensive contracts. The official address is: Westinghouse, Church, Kerr & Co., Westinghouse Building, Pittsburg, Pa.

Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 8, 1902.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

703,980. COMBINED SWITCH AND LIGHTNING ARRESTER; W. J. Bell, Baraboo, Wis. App. filed March 26, 1902. A movable switch arm which opens and closes the main telephone circuit, and plays across the face of a carbon block so that regardless of whether the switch be open or closed, it will carry a lightning charge to ground through the block.

703,984. SUPPORTING DEVICE FOR ELECTRIC LAMPS; W. F. Brewster, New York, N. Y. App. filed Dec. 19, 1901. The lamp sockets are mounted upon a chain of links so that their positions can be arranged to form letters and figures for sign purposes.

703,989. MAGNETO THERAPEUTIC APPARATUS; J. Burry, Fort Lee, N. J. App. filed May 8, 1900. A solenoid through which alternating currents are passed to create a changing magnetic field into which the diseased portion of the body is thrust for treatment.

704,010. APPARATUS FOR CONCENTRATING MAGNETIC IRON ORES. T. A. Edison, Llewellyn Park, N. J. App. filed May 23, 1898. A connected apparatus comprising grinding rolls, screens, magnetic separators and drying apparatus arranged in a series.

704,019. ELECTRICAL TRANSPORTATION SYSTEM; H. F. Freed, Harrisburg, Pa. App. filed March 11, 1901. Details of automatic switching apparatus for electric cash and parcel carriers.

704,023. TELEGRAPH; C. E. Fritts, New York, N. Y. App. filed April 2, 1881. The line is divided up into sections connected in series by condensers, the transmission being thus effected by induction.

704,092. CONTACT SYSTEM FOR ELECTRIC RAILWAYS; T. B. Patch, North Cambridge, Mass. App. filed Nov. 29, 1901. Standards are erected along the side of the track and carry at their upper ends contact pieces suitablly insulated, with which the brush carried by the car makes connection.

704,093. CONTACT SYSTEM FOR ELECTRIC RAILWAYS; T. B. Patch, North Cambridge, Mass. App. filed April 4, 1902. A modification of the preceding invention.

704,099. ELECTRIC MOTOR REGULATION; O. H. Pieper and A. F. Pieper, Rochester, N. Y. App. filed March 24, 1899. A variable resistance is connected in shunt across the armature of a machine for alternating currents, in which the field winding and armature are connected in series, as customary in constant current motors.

704,113. CIRCUIT CLOSER FOR PORTABLE ELECTRICAL APPARATUS; W. Roche, Jersey City, N. J. App. filed Dec. 5, 1901. Details of a spring circuit closer fixed to the outside of a case adapted to contain battery cells and a bull's eye lamp.

704,117. SIGNALLING SYSTEM; J. J. Ruddick, Newton, Mass. App. filed July 26, 1901. In a block signal system for railways, a power circuit including a main conductor and a return wire, a single signal-circuit including a signal, said signal-circuit normally having both ends thereof connected to the same side of the power-circuit, means operated by a car entering the block to connect one end of said signal-circuit to the opposite side of the power-circuit and means operated by the same car on leaving the block to connect the other end of said signal-circuit to said opposite side of the power-circuit.

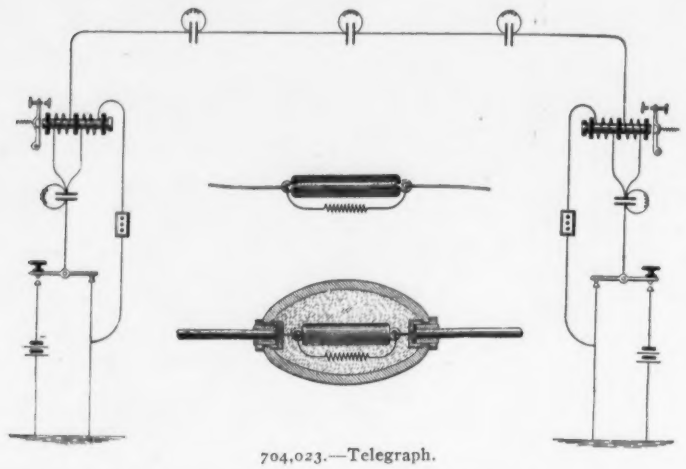
704,125. BATTERY; W. T. Seddon, Minersville, Pa. App. filed July 20, 1901. Alternate zinc and carbon element, the latter being in the form of hollow boxes and containing a liquid depolarizer.

704,127. COMBINED DISTRICT TELEGRAPH AND TELEPHONE SIGNAL; C. Selden, Baltimore, Md. App. filed Jan. 25, 1902. (See page 96.)

704,165. TELEGRAPHIC SAFETY DEVICE; S. R. Wright, Morton, N. Y. App. filed Dec. 13, 1901. A time switch adapted to close a telegraph circuit after a predetermined interval, in case the operator unintentionally leaves the circuit open.

704,172. INSULATOR; J. E. Calvin, Camptonville, Cal. App. filed May 1, 1902. A base having a longitudinally slotted screw-threaded post into the slot of which the wire is inserted and a cap then screwed over the post.

704,177. ELECTRICAL APPARATUS FOR OPERATING RAILWAY SWITCHES AND SIGNALS; T. Ducousso, Paris, France. App. filed Sept. 22, 1898. An electro-magnetic interlocking system for controlling the switches and signal.



704,023.—Telegraph.

704,202. SWITCHING APPARATUS; C. Michalke, Charlottenburg, Germany, App. filed Nov. 18, 1899. Details.

704,246. BURGLAR ALARM; P. W. Dunne, River Forrest, Ill. App. filed March 30, 1901. A window shade carries wires through its fabric which form a part of an alarm circuit necessarily closed by the movement or injury of the shade.

074,247. BURGLAR ALARM; C. Fruehauf, Chicago, Ill. App. filed Dec. 26, 1901. Details.

704,252. PROCESS OF MAKING PLATES FOR STORAGE BATTERIES AND PRODUCT THEREOF; H. K. Hess, Philadelphia, Pa. App. filed July 30, 1901. The active material and a number of metal plates are compressed together in a suitable mold to form a self-supporting plate.

704,264. CONTROLLING SYSTEM FOR ELECTRIC HOISTS OR ELEVATORS; A. E. Maccoun, Braddock, Pa. App. filed April 29, 1898. An automatic switch for slowing down and stopping the motor at each end of its travel.

704,271. CONTROL DEVICE FOR HOISTING MACHINES; G. H. Reynolds, Chicago, Ill. App. filed Dec. 29, 1898. Automatic regulating devices connected to some moving part of the apparatus, for reducing the speed of the motor before the hoist reaches the limit of its movement.

704,303. REVERSIBLE GALVANIC BATTERY; T. A. Edison, Llewellyn Park, N. J. App. filed Jan. 8, 1901. (See page 92.)

704,304. REVERSIBLE GALVANIC BATTERY; T. A. Edison, Llewellyn Park, N. J. App. filed March 1, 1901. (See page 92.)

704,305. ELECTRODE FOR BATTERIES; T. A. Edison, Llewellyn Park, N. J. App. filed May 17, 1901. (See page 92.)

704,306. REVERSIBLE GALVANIC BATTERY; T. A. Edison, Llewellyn Park, N. J. App. filed June 20, 1901. (See page 92.)

704,322. ELECTRICAL PUSH AND SWITCH; Edgar G. Harcourt, Birmingham, Eng. App. filed July 9, 1901. The usual base of a push-button is provided with an apertured flange on its upper side, through which projects a spring catch. The dome of the button has a curve on its inner side to engage the catch, and a recess in its lower edge intersecting the curve.

704,323. AUTOMATIC ELECTRIC SEMAPHORE SIGNAL; J. N. Harper, Kansas City, Mo. App. filed April 25, 1901. Details.

704,336. REVERSING SWITCH MOTOR; J. D. Ihlder, Yonkers, N. Y. App. filed April 4, 1899. A safety reversing switch in which the movements of the switch arms are interdependent upon one another so that they will have to operate in a certain prearranged order.

704,337. CONTROLLING SYSTEM FOR ELECTRIC ELEVATORS; J. D. Ihlder, Yonkers, N. Y. App. filed Jan. 11, 1902. The invention consists primarily in apparatus for controlling motors provided with a controlling circuit of lower potential than the main circuit and so arranged that after it has been energized to operate the motor it is automatically rendered inoperative during the operation of the motor.

704,338. CONTROLLING SYSTEM FOR ELECTRIC ELEVATORS; J. D Ihlder, Yonkers, N. Y. App. filed Jan. 13, 1902. A modification of the preceding invention in which a portion only of the low potential controlling circuit is cut out during the operation of the motor, the portion remaining in being used for the safety appliances.

704,347. RAILROAD SIGNALLING SYSTEM; A. W. Knee, Syracuse, N. Y. App. filed March 7, 1902. Details.

704,349. PROCESS OF MANUFACTURING RICE-STARCH OR OTHER AMYLACEOUS SUBSTANCES; Eugene Leconte, Estaires, and Jerome Loiselet, Paris, France. App. filed March 15, 1901. Starchy substances are treated with successive alkaline solutions of decreasing strength. After washing and milling, the mass is subjected to the action of an alternating current while in an alkaline solution.

704,361. ELECTRIC CUT OUT; G. N. Oehmen, Brooklyn, N. Y. App. filed Dec. 14, 1901. A thermostatic tripping or releasing device.

704,371. VOLTAGE REGULATOR; T. M. Pusey, Kennett Square, Pa. App. filed Aug. 5, 1901. Details.

704,393. MANUFACTURE OF IRON, MANGANESE AND ALLOYS OF THESE METALS BY AID OF ELECTRICITY; Albert Simon, Bordeaux, France. App. filed Feb. 27, 1901. Carbon is added to the material to be treated, and an electrolyte consisting of fluorite of calcium, the mass being then subjected to the action of a direct electric current, which causes electrolytic decomposition and keeps the material in a fluid condition. ffl

704,398. SAFETY DEVICE; A. Sundh, Yonkers, N. Y. App. filed Oct. 12, 1901. A safety device comprising means in the circuit of the shunt field of a motor controlling the armature circuit and means controlled by the armature circuit for bringing the motor to a stop when the armature circuit is broken or when the field circuit is broken.

704,399. STAINED GLASS WINDOW OR SIMILAR OBJECT AND PROCESS OF MAKING SAME; J. Taluau, Philadelphia, Pa. App. filed Dec. 16, 1895. (See page 96.)

704,400. METHOD OF FRAMING GLASS; J. Taluau and H. W. Scattergood, Philadelphia, Pa. App. filed June 30, 1897. (See page 96.)

704,401. METHOD OF FRAMING GLASS; J. Taluau, Philadelphia, Pa. App. filed March 22, 1898. (See page 96.)

704,423. WALL PLATE OR SHIELD FOR ELECTRIC WIRES; B. W. Allen, Boston, Mass. App. filed Feb. 26, 1902. A ring is secured to the wall around the projecting wires; the ring has a forwardly projecting, screw-threaded flange upon which a cap screws, the cap having a central opening for the wire.

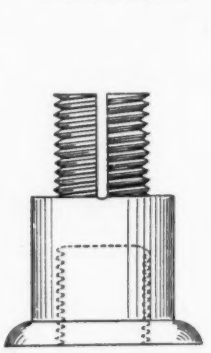
704,424. JUNCTION BOX FOR ELECTRIC WIRES IN BUILDINGS; B. W. Allen, Boston, Mass. App. filed Feb. 26, 1902. Details.

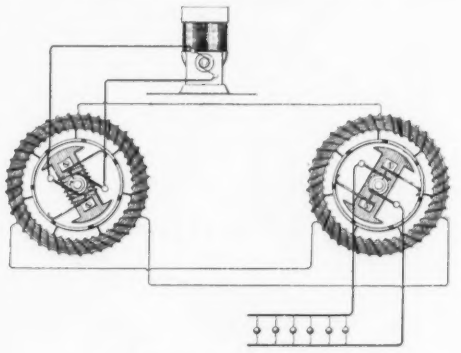
704,425. JUNCTION BOX FOR ELECTRIC WIRES IN BUILDINGS; B. W. Allen, Boston, Mass. App. filed March 8, 1902. Details.

704,439. THERMAL PROTECTOR FOR ELECTRIC CIRCUITS; F. B. Cook, Chicago, Ill. App. filed July 29, 1896. (See page 97.)

704,446. WATCH DIAL ILLUMINATOR; F. M. Durkee, Newton, Mass. App. filed Sept. 26, 1901. A battery casing adapted to be fastened to the wall and having in front of it a hook upon which a watch may be hung, also a small lamp mounted in a position to throw its light upon the face of the watch whenever the circuit is closed.

704,447. PROTECTIVE OPERATING DEVICE FOR ELECTRIC MOTORS: A. C. Eastwood, Cleveland, O. App. filed Nov. 16, 1901. A rheostat in which the arm is drawn into connection with the contacts as soon as the current flows through a magnet and a spring lifts the arm as soon is the circuit is broken.





704,172.—Insulator. 704,453.—Means for Changing the Tension of Currents.

704,478. RHEOSTAT; A. C. Eastwood, Cleveland, O. Filed April 10, 1902. A rheostat consisting of a core upon which is strung a number of rings consisting of high resistance material coated with low resistance material, the connection between them being established through the coating.

704,453. MEANS FOR CHANGING THE TENSION OF CURRENTS; W. M. Fairfax, Brooklyn, N. Y. App. filed Oct. 11, 1892. A system in which a low tension current can be changed into a high tension alternating current and conveyed to a distance and there reconverted into a low tension current, the circuits and connections by which the high tension alternating current is induced and transmitted, being unchanged during the operation of the apparatus.

704,484. SYSTEM OF ELECTRIC DISTRIBUTION; C. J. A. Michalke, Charlottenburg, Germany. App. filed Dec. 31, 1897. The system constituting the present invention comprises a receiving device, one of the members of which is provided with a plurality of angularly-displaced windings and a subdivided source of single phase current connected thereto through a switching means in such a manner that the rotation of the device constituting the switching means will cause the currents supplied to the angularly-displaced windings to be varied in such a manner as to produce a continuous progression of the magnetic field generated thereby.